California State Auditor

BUREAU OF STATE AUDITS

Department of Transportation:

Various Factors Increased Its Cost Estimates for Toll Bridge Retrofits, and Its Program Management Needs Improving

December 2004
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CALIFORNIA STATE AUDITOR

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December 22, 2004 2004-140

The Governor of California
President pro Tempore of the Senate
Speaker of the Assembly
State Capitol
Sacramento, California 95814

Dear Governor and Legislative Leaders:

As requested by the Joint Legislative Audit Committee, the Bureau of State Audits presents its audit report on the Department of Transportation's (Caltrans) Toll Bridge Seismic Retrofit Program (program). The report examines the cost increases for the program between its budget established in 2001 and its August 2004 cost estimate, as well as Caltrans' project management practices for the program.

This report concludes that the $3.2 billion increase in estimated program costs and the four-year time delay in the program occurred for many reasons, but the replacement of the San Francisco-Oakland Bay Bridge's east span (East Span) was the largest contributor, with an estimated cost increase of $2.5 billion. However, only $930 million of the $3.2 billion cost increase relates to the bid for the superstructure of the East Span's signature span; the remainder is attributable to increases for other cost categories such as Caltrans' support costs and the program contingency reserve, which rose by $556 million and $452 million, respectively. According to Caltrans, costs may rise even further as the contract to construct the superstructure for the East Span's signature span has expired and Caltrans must now either rebid or redesign this section of the bridge.

Despite the East Span's extraordinary strategic, technical, and financial risks, Caltrans failed to create a risk management plan, track risks that it identified, or update its cost estimates and contingency reserve to reflect those risks. Further, Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide update of cost estimates since April 2001. Finally, as early as November 2003, when it reported the program's financial status to the Federal Highway Administration, Caltrans should have known that the program would experience large cost overruns. At that time, Caltrans failed to recognize that it had only a year and a half of support costs funding remaining though the program was to last eight more years, that the bid for the signature span's superstructure would be much higher than its official estimate, and that its remaining program contingency reserve of $122 million was inadequate given the uncertainty facing the program.

Respectfully submitted,

Elaine M. Howle

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SUMMARY

Audit Highlights . . .

Our review of the Department of Transportation's (Caltrans) Toll Bridge Seismic Retrofit Program (program) found that:

- ☑ *Cost estimates have increased $3.2 billion since April 2001, including a $900 million program contingency reserve.*
- ☑ *Approximately $930 million of the $3.2 billion increase relates to the May 2004 bid for the superstructure of the signature span of the San Francisco-Oakland Bay Bridge's east span (East Span); the remainder is attributable to other cost categories.*
- ☑ *Various factors have driven cost increases including volatile markets for steel and contractor services, a lengthening of the East Span's timeline, and Caltrans' past experience with the program, which is reflected in contingency reserves.*

continued on next page . . .

RESULTS IN BRIEF

Many of California's largest and most complex bridges are located in areas of high seismic risk, such as the San Francisco Bay Area (Bay Area). After the 1989 Loma Prieta earthquake, the Legislature imposed higher seismic safety standards for publicly owned bridges, and the Department of Transportation (Caltrans) already has retrofitted most of them. Caltrans determined that seven state-owned toll bridges would need seismic retrofitting. For the San Francisco-Oakland Bay Bridge (Bay Bridge), Caltrans decided that the west span needed retrofitting and the east span (East Span) needed replacing in order to satisfactorily serve as a "lifeline structure," which continues in service after an earthquake. Caltrans' 2001 cost estimate to complete all this work, established by Chapter 907, Statutes of 2001—Assembly Bill 1171 (AB 1171)—amounted to $5.1 billion, including a $448 million program contingency reserve to cover unforeseen costs. At that time, Caltrans projected that the program would be completed in 2009, but now the program faces a financial crisis and is jeopardized by sharp increases in cost estimates and major schedule delays. In August 2004, Caltrans informed the Legislature that the program could cost $8.3 billion—$7.4 billion for specific projects and a $900 million contingency reserve for possible cost increases on those projects—and would be completed no sooner than 2013.

The largest contributor to the estimated $3.2 billion cost increase has been the East Span component known as the signature span. Of this $3.2 billion, $930 million is attributable to the May 2004 bid to build the superstructure of the signature span. The remaining $2.3 billion is due to factors unrelated to the superstructure bid, such as $556 million in additional Caltrans support costs and the need for a $900 million program contingency reserve above the $7.4 billion Caltrans has allocated to specific projects. Increased timelines and schedule delays in contracting for the signature span have been the greatest factors in pushing out the program's estimated completion date. Further affecting the steep rise in cost estimates has been the unparalleled nature of retrofitting such complex bridges. Caltrans indicates that nowhere in the world have bridges as complex been designed or built to today's

high seismic standards. This unprecedented retrofit program has created cost uncertainty by limiting the ability to draw from past experiences and to employ traditional estimating practices.

Caltrans neglected several important aspects of generally accepted standards for project management. Specifically:

- ☑ *Caltrans did not create a comprehensive risk management plan for the East Span, and lacked processes to identify, track, and quantify risks throughout this project's life.*
- ☑ *Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide update of cost estimates since April 2001.*
- ☑ *Caltrans failed to disclose information to the Legislature according to the law's regular reporting schedule and disclosed huge cost overruns long after it should have been aware of them.*
- ☑ *In November 2003, Caltrans' financial plan update to the Federal Highway Administration did not reveal the probable extent of estimated program costs. At that time, based on internal reports, Caltrans should have known that the program was over budget.*

Many factors affected the rising cost estimates to complete the program. It is difficult to attribute dollar effects to specific causes because of this multiplicity of factors and the proprietary nature of the data supporting contractors' bids. Caltrans' standard contract provisions limit its access to the information supporting contractors' bid prices. It may not disclose such information, as it is acknowledged to constitute trade secrets and is not deemed a public record. However, our analysis suggests that various market and project developments have driven the cost increases. Volatile markets for materials and contractor services have yielded bids that include higher than expected steel and contractor overhead costs. Caltrans' efforts to increase competition among contractors by extending the advertisement period and extending the period to build the signature span's superstructure have lengthened the program's timeline, increasing the period during which support services are required and escalating capital costs for projects not yet started. In addition, Caltrans' experience with costs overruns and delays on this program and other recent bridge projects have led it to increase contingency reserve levels to cover the cost of known potential risks and unknown risks for individual projects and the overall program.

Unfortunately, the program's costs could go higher. Caltrans' August 2004 cost estimates assumed it would accept a $1.4 billion offer to construct the signature span's superstructure. However, because Caltrans let this offer expire, the program likely will experience further delays as Caltrans considers rebidding or redesigning this section of the East Span. Bechtel Infrastructure Corporation (Bechtel), a consultant that helped Caltrans develop its August 2004 estimates, agreed with Caltrans that failure to accept the superstructure bid likely would delay program completion and lead to higher costs.

Managing a program of this size, complexity, and cost requires a consistently high level of diligence in applying accepted project management practices. However, Caltrans has not fully incorporated generally accepted standards for project management. This report considers Caltrans' efforts in managing project risk, cost, and communications—areas in which it could have guided the program better to achieve the maximum chance of success. In the area of risk management,

the report focuses on the East Span, which accounts for $2.5 billion of the $3.2 billion in cost overruns and the four-year delay. Although Caltrans took steps to identify and mitigate risks to the East Span project, such as hiring consultants to perform a risk assessment in February 2003, it lacked a comprehensive risk management plan for the East Span. Without a risk management plan, Caltrans never defined its risk management activities for the program. As a result, Caltrans lacked processes to identify, track, and quantify risks throughout the project's life.

In managing the project's cost, Caltrans has not followed generally accepted cost management practices to ensure that the project could be completed within its 2001 budget, approved by the Legislature in AB 1171. Caltrans did not regularly update its cost estimates for some components of the East Span or the entire program, including updating estimates for capital and support costs. Also, Caltrans did not use information about identified risks to regularly reassess its contingency reserves for potential claims and unknown risks. For example, Caltrans indicated to the Federal Highway Administration (FHWA) in February 2004 that its program support costs would be $766 million, $30 million less than the AB 1171 estimated amount. However, Caltrans' accounting records show that it already had spent $612 million in support costs by October 2003, leaving only $154 million to pay such costs for eight more years, through 2011. Just six months later, in August 2004, it raised its estimated support costs to $1.352 billion. Without updated cost estimates, Caltrans' program managers forgo the benefits of a detailed overview of the program's capital and support costs for all the bridges. Further, Caltrans indicates that since October 2001, when AB 1171 was passed, its only published program-wide cost update was the August 2004 report, which disclosed the $3.2 billion cost overrun. Had it been monitoring the program's costs regularly, Caltrans would have realized much earlier that the program was exceeding its budget under AB 1171.

Finally, Caltrans has neglected communications planning and management, failing to inform significant stakeholders regularly of relevant changes in its estimates of program costs and cost overruns. State law requires Caltrans to provide periodic status reports to the Legislature, but Caltrans provided no statutorily required annual status report for 2003 and no statutorily required quarterly status report in 2004 until August of that year. It chose not to disclose program information according to the regular

reporting schedule established by law and disclosed the large cost overruns long after it should have known that the program likely would exceed its budget. As a consequence, Caltrans placed the Legislature in the awkward position of having to try to devise a funding solution six weeks before the bid on the signature span's superstructure was set to expire.

In November 2003, Caltrans submitted a legally required financial plan update to FHWA showing that the program's projects were going beyond the AB 1171 cost levels and that less than a 3 percent program contingency reserve remained—$122 million—to fund further cost overruns in the eight years left to complete the project. In response to FHWA's questions about the financial plan, Caltrans did not reveal the probable extent of estimated program costs: at the time of the report, Caltrans' internal analyses showed that it would likely exceed the AB 1171 budget. Based on internal Caltrans' reports and the amounts it eventually reported to the Legislature in August 2004, Caltrans should have known about the huge cost overruns. For example, although Caltrans had advertised the contract for the signature span's superstructure at $733 million, internal analyses showed that as early as August 2002 this contract could be as high as $934 million, while later estimates placed its potential price at more than $1 billion. Further, the uncommitted balance of $122 million in the contingency reserve was grossly insufficient given that Caltrans had not received the superstructure bid, the East Span's skyway was only 31 percent constructed, and the Richmond-San Rafael Bridge retrofit costs were underreported by $43 million to $78 million.

In fact, in its report to FHWA, Caltrans claimed it would save $130 million in three areas, thus allowing it to assert that it had a program contingency reserve of $122 million. However, by August 2004, Caltrans reported for those same three areas (unrelated to the capital costs of the superstructure bid) that it would not save $130 million from AB 1171 estimates and that it would need $748 million more than AB 1171 estimates for a total of $878 million more than it reported to FHWA just six months earlier.

RECOMMENDATIONS

To ensure that it properly manages the risks associated with large construction projects, Caltrans should continue to revise its risk management practices, but ensure that its efforts include:

- Establishing a comprehensive risk management plan that clearly defines roles and responsibilities for risk management and addresses how it will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the life of the project.

- Quantifying the effect of identified risks in financial terms.

- Developing and maintaining documents to track identified risks and related mitigation steps.

To ensure that it follows generally accepted practices for cost management, Caltrans should:

- Regularly update its estimates of capital and support costs.

- Regularly reassess its reserves for potential claims and unknown risks, incorporating information related to risks identified and quantified through its risk assessment processes.

- Regularly integrate estimates for capital, support costs, and contingency reserves into a program-wide report.

To ensure that it keeps its stakeholders informed on the status of projects, Caltrans should:

- Submit quarterly status reports to the Legislature, as the law requires.

- Ensure that reports to FHWA and other stakeholders reflect current data and provide an accurate representation of the program's status.

- When key events occur, such as a bid opening for a major project, quickly inform stakeholders how these key events affect the program's overall budget and schedule.

The Legislature should consider revising state law to require that Caltrans submit its quarterly reports within a certain period after each quarter, such as 45 days, to ensure that the information that Caltrans provides is current. The Legislature should also consider changing state law to require that the quarterly reports provide a program-wide summary of the program's budget status for both capital outlay and support costs.

In reviewing the options that Caltrans presents for completing the East Span, the Legislature should consider requesting that Caltrans provide sufficient detail to understand the financial implications of each option. Specifically, this detail should include for each option a breakdown of the costs for capital outlay, support, and contingencies at the project and program level. Further, to place each option in perspective, Caltrans should provide a reconciliation of each option to the figures it presented in its August 2004 report to the Legislature.

AGENCY COMMENTS

Caltrans and the Business, Transportation and Housing Agency provided clarifying comments to the report, and Caltrans indicated the steps it would take to implement the report's recommendations. The Metropolitan Transportation Commission had no comments on the report. ■

INTRODUCTION

BACKGROUND

The Department of Transportation (Caltrans) is responsible for the design, construction, maintenance, and operation of California's state highway system. Caltrans is also responsible for assessing the seismic safety of all publicly owned bridges, except those outside the state highway system in Los Angeles and Santa Clara counties. In October 1989, the Loma Prieta earthquake presented Caltrans with the task of repairing or replacing damaged highway facilities in the San Francisco Bay Area (Bay Area). To meet the higher seismic safety standards established after the Loma Prieta earthquake, the State created a seismic retrofit program that required the retrofit or replacement of all California's publicly owned bridges, including highway overpasses and other structures. The seismic retrofit program requires that Caltrans identify the seismic vulnerability of bridges and develop a retrofit project to address structural deficiencies. Retrofits may include, among other things, reinforcing bridge columns and strengthening bridge footings.

After reviewing all 12,000 state highway bridges, Caltrans identified 750 single- and multiple-column bridges that needed seismic retrofit and were either the most vulnerable to a seismic event or necessary for emergency response during a widespread civil disaster. Caltrans also determined that seven (see text box) of nine state-owned toll bridges needed seismic retrofitting; the other two state-owned toll bridges, Antioch and Dumbarton, did not need retrofits because they were built after the State imposed new seismic construction standards in 1971. Repairs on the seven identified toll bridges did not begin immediately, however, because retrofit strategies for such complex structures did not exist at the time.

Caltrans Identified Seven Toll Bridges Needing Seismic Retrofits

1. Benicia-Martinez Bridge
2. Carquinez Bridge
3. Richmond-San Rafael Bridge
4. San Diego-Coronado Bridge
5. San Francisco-Oakland Bay Bridge
6. San Mateo-Hayward Bridge
7. Vincent Thomas Bridge

After the 1994 Northridge earthquake, Caltrans expanded and revised its seismic retrofit program for state highway bridges (except the toll bridges) by implementing a two-phase retrofitting approach. Phase 1, completed in May 2000, included retrofitting 1,039 bridges that were identified during Caltrans' first screening process. Phase 2, an ongoing effort, includes retrofitting

an additional 1,155 bridges that Caltrans identified after the Northridge earthquake. As of June 2004, Caltrans had completed retrofitting 1,137 (or 98 percent) of its phase 2 bridges. Completion of the remaining 18 bridges is not expected until early 2010 because of the more complex retrofit and replacement work needed on a number of these bridges.

THE TOLL BRIDGE SEISMIC RETROFIT PROGRAM PLANS TO REPLACE THE EAST SPAN OF THE SAN FRANCISCO-OAKLAND BAY BRIDGE

Caltrans is managing the retrofit and replacement strategies for the state-owned toll bridges separately from the above two phases, under the Toll Bridge Seismic Retrofit Program (program). After the Loma Prieta earthquake, Caltrans engaged two universities, numerous private consulting firms, and the Lawrence Livermore National Laboratory to conduct research to better understand the toll bridges' seismic vulnerabilities. In the last half of the 1990s, Caltrans began preparing retrofit strategies for each of the toll bridges, with the exception of the east span of the San Francisco-Oakland Bay Bridge (East Span), which Caltrans scheduled for replacement as explained later. As of August 2004, Caltrans had finished seismic retrofits for the Benicia-Martinez, Carquinez, San Diego-Coronado, San Mateo-Hayward, and Vincent Thomas bridges, leaving only the Richmond-San Rafael Bridge and the San Francisco-Oakland Bay Bridge to complete.

Lifeline Serviceability

1. Allows emergency relief access to and through the affected region.
2. Connects major population centers within the affected region.
3. Serves as the most effective of several routes for emergency relief access.
4. Provides direct or nearby access to and from major emergency supply centers.
5. Links various modes of transportation.
6. Provides access to major traffic distribution centers.

Source: Caltrans' District 4 Web site.

Caltrans identified the East Span as necessary for emergency access and recommended replacing it. With the assistance of a seismic advisory board and a toll bridge peer review panel of experts in the fields of seismology, transportation engineering, and bridge design, Caltrans recommended the East Span be built to achieve "lifeline serviceability" after an earthquake (see textbox). Lifeline structures are designed to exceed the typical standard, which is meant to prevent the immediate collapse or catastrophic failure of bridges but not necessarily enable them to continue in service. Lifeline structures are designed to continue functioning after an earthquake to provide transportation services and support for a region's economy. Nevertheless, to reduce Bay Area

commuters' risk from a moderate-level earthquake before the construction of a new East Span, Caltrans completed an interim retrofit of the existing East Span in June 2000.

Caltrans has decided to reevaluate the Antioch and Dumbarton bridges, although it earlier had decided that they did not require seismic retrofits. According to the chief deputy district director of the program (chief deputy), Caltrans has not conducted any studies or analyses that indicate these bridges need retrofitting, nor is it aware of any such studies during the last 15 years. However, based on the slowly accumulating body of knowledge on seismic safety, the chief deputy says that Caltrans' current plan is to evaluate the need for seismic retrofits using a two-phase approach. The first phase will involve the testing of two components of each bridge. If this effort indicates further testing is warranted, Caltrans plans to pursue a more rigorous phase of testing in 2005. The chief deputy stated that without further information Caltrans cannot estimate what seismic retrofits on the bridges might cost, if they are actually needed. Rather than use toll bridge seismic retrofit program funds, Caltrans requested to use Regional Measure 1 (measure 1) funds from the Bay Area Toll Authority (BATA) to pay for the initial testing, which is estimated to cost $200,000. However, in December 2004, BATA told Caltrans that it could not recommend an allocation of measure 1 funds for this purpose.

A 1997 Law Set the Program's Budget at $2.6 Billion and Allowed for the Purchase of East Span Amenities

To finance the $1.1 billion actual cost of retrofitting the phase 1 bridges, Caltrans indicated it drew mostly from various federal sources, which could not provide sufficient funds for retrofitting or replacing the phase 2 bridges or the toll bridges. Therefore, in March 1996 California voters approved the Seismic Retrofit Bond Act of 1996 authorizing the sale of $2 billion in general-obligation bonds, with $1.4 billion earmarked for the phase 2 bridges and $650 million for the toll bridges. However, the toll bridges required substantially more funding, so in 1997 the Legislature passed Senate Bill 60 (SB 60) allocating an additional $2 billion, mostly from state highway funds and a newly created seismic surcharge of $1 per vehicle imposed for passage on all Bay Area toll bridges (seismic surcharge). SB 60 also allocated tolls collected on the San Diego-Coronado and Vincent Thomas bridges to the program. The total cost estimate established in SB 60 for the program was $2.6 billion.

In late 1996, Caltrans completed cost estimates for several different alternatives for the East Span. It recommended construction of a concrete "skyway" bridge spanning the San Francisco Bay between Oakland and Yerba Buena Island. Caltrans estimated the price tag for this replacement at $1 billion. Figure 1 shows Caltrans' recommended design for the east span of the Bay Bridge.

FIGURE 1

Caltrans Recommended a Skyway Bridge Design for the Bay Bridge East Span Replacement

However, the replacement recommended by Caltrans was not commissioned for construction. As the regional transportation planning, coordinating, and financing agency for the Bay Area, the Metropolitan Transportation Commission (commission) was given the authority under SB 60 to select the new East Span replacement, including the option of incorporating certain amenities such as a more expensive bridge design than originally envisioned and a bicycle/pedestrian path, as long as bridge users pay for the increase in costs. In June 1998, the commission exercised its option and selected a bridge design that differed from Caltrans' recommendation.

The Commission Chose a Self-Anchored Suspension Design for the East Span

The commission's design was a combination skyway and self-anchored suspension span known as the signature span. Although the skyway section was similar to Caltrans' proposed design, the signature span was envisioned as a landmark structure, with a single tower rising 525 feet above sea level. Figure 2 depicts the commission's selection for the east span of the Bay Bridge, including the signature span. The commission based its decision on a preliminary bridge design and cost estimates available in May and June 1998, which were prepared by a joint venture design team under contract to Caltrans. At the time, Caltrans' preliminary estimates indicated that the self-anchored suspension, or signature span, design selected by the commission would cost more than $1.1 billion, or $141 million more than the simpler skyway bridge it had recommended. As SB 60 allowed and intended, the commission extended the Bay Area toll bridge seismic surcharge, set to expire no later than January 2008, to January 2010 to pay for the East Span amenities.

FIGURE 2

The Commission Chose a Signature Span Bridge Design for the Bay Bridge East Span Replacement

Funds Designated for the Toll Bridge Seismic Retrofit Program Rose to $5.1 Billion in 2001

In April 2001, Caltrans' annual report to the Legislature and governor detailed rising cost estimates and project time delays for the program. The annual report contained revised cost estimates and project completion dates, along with explanations of the anticipated cost increases, showing that the East Span replacement was the largest contributor to the overall projected cost increase, with an anticipated rise of $1.3 billion over SB 60's initial cost estimate. The Richmond-San Rafael Bridge was the next largest contributor to the higher estimates, with $336 million in expected additional costs.

In 2001, in response to Caltrans' annual report, the Legislature passed Assemply Bill 1171 (AB 1171) to fund the program's cost increases. This legislation allocated an additional $2 billion in Bay Area seismic surcharge proceeds and federal bridge funds to the retrofit effort, increasing funding to $5.1 billion, including a program contingency reserve of $448 million. AB 1171 allowed the commission to request that the seismic surcharge be extended to January 2038, subject to the approval of the director of Caltrans, to raise additional funds to cover the cost increases and other eligible transportation projects. The commission requested and received approval for this extension.

Table 1 shows that by June 30, 2004, Caltrans had received much of the funds designated for the program under AB 1171. Most of these funds relate to seismic surcharges or the proceeds of revenue bonds that will be repaid with seismic surcharges. AB 1171 limited the amount of seismic surcharges that can be collected for the program to nearly $2.3 billion, plus the interest that will be paid on the revenue bonds. According to the August 2003 official statement for the revenue bonds, interest costs will total $1.3 billion. Because no change has been made to this provision, no extra toll revenues have been made available to the program to pay for increased capital costs of the signature span or any other component of the program. As of June 30, 2004, the Toll Bridge Seismic Retrofit Account, the fund that receives toll revenues and pays the majority of program expenditures, did not have any loans outstanding to or receivables due from other funds beyond those required to support the everyday administration of the program.

TABLE 1

Caltrans Is Receiving AB 1171's Funding (In Millions)

Funding Source	AB 1171 Funding Estimates	Actual Funds Received as of June 2004	Balance Not Yet Received
Bay Area Seismic Surcharge*	$2,282	$1,819	$ 463
State Highway Account	795	455	340
Transportation Planning and Development Account	80	10	70
Seismic Retrofit Bond Act of 1996	790	780	10
San Diego-Coronado Toll Bridge Revenue Account	33	33	0
Vincent Thomas Toll Bridge Revenue Account†	15	0	15
Federal Highway Bridge Replacement and Rehabilitation Program	642	250	392
Subtotals—Funding for Identified Program Costs	4,637	3,347	1,290
Contingency reserve‡	448	0	448
Totals	**$5,085**	**$3,347**	**$1,738**

Source: Chapter 907, Statutes of 2001 (AB 1171), and Caltrans Division of Accounting.

* Funds received include $1.062 billion in proceeds of seismic surcharge revenue bonds issued in 2003, which will be repaid with seismic surcharges.

† Caltrans indicates that transfers from the Vincent Thomas Toll Bridge Revenue Account will not meet the AB 1171 estimate of $15 million. Because the bridge no longer collects toll revenue, only $7 million is available for transfer.

‡ Caltrans anticipates the funding source to be the State Highway Account, identified as State Highway Operations and Protection Program expenditures. Since contributions are not scheduled to begin until fiscal year 2008–09, as of October 2004, Caltrans has not yet requested these funds from the California Transportation Commission.

In 2002, the Bureau of State Audits Raised Concerns About Further Cost Increases

In August 2002, the Bureau of State Audits issued a report on the program that identified factors that caused program cost estimates to increase between SB 60 and AB 1171. The report also noted that remaining contingency levels indicated that costs could rise further. Table 2 on the following page briefly describes the report's scope and findings. The report had no recommendations.

IN 2004, CALTRANS' ESTIMATES FOR THE PROGRAM ROSE TO $8.3 BILLION

On August 16, 2004, Caltrans reported to the Legislature that project time delays and rising cost estimates had increased the program's projected cost to $8.3 billion, an increase of $3.2 billion over its 2001 estimate in AB 1171 of $5.1 billion. The East Span, with an anticipated shortfall of $2.5 billion,

TABLE 2

Scope and Findings of the Bureau of State Audits August 2002 Report

Report's Scope:
Evaluate underlying reasons for delays and higher cost estimates for the program.
Determine the role of Caltrans and the commission in planning, implementing and managing program costs.
Determine whether procedures for modifying cost estimates and completion dates are adequate.
Examine a cost review prepared by a commission-hired consultant to identify projects whose costs were likely to be higher than Caltrans' estimates.
Report's Findings:
Costs increased in part because initial legislation allowed the commission to purchase amenities for the East Span not originally included by Caltrans.
Costs for the East Span increased because of efforts by the U.S. Navy to impede test drilling and a delay in the environmental review process.
A few bridges experienced cost increases because of difficulties in estimating costs for underwater work.
Caltrans' failure to include escalation rates in most of its estimates played a role in the understatement of cost estimates in the initial legislation.
In 2001, the Bechtel Infrastructure Corporation, a commission-hired consultant, concluded that program costs might be $250 million to $630 million higher than those reported by Caltrans.
By early 2002, the skyway component of the East Span already had used up a large and disproportionate share of the East Span's contingency reserve, indicating that the East Span could experience a funding shortfall.

is the largest contributor to that increase. The other major increases in estimated costs were a $452 million rise in the program contingency reserve and $249 million in cost overruns for the Richmond-San Rafael Bridge. Caltrans stated that the commission and Bechtel Infrastructure Corporation (Bechtel) had reviewed the overall program's estimated cost and had reached consensus with Caltrans on a funding shortfall of $3.2 billion, including a $900 million program contingency reserve. Caltrans attributed the cost increases to a number of factors, but chief among them were significant changes in financial, insurance, and bonding markets; higher materials and labor prices; industry consolidation; and delays resulting in additional cost escalation and increased support costs. We further discuss the factors behind cost increases in Chapter 1.

Caltrans observed that the extent and timing of the cost increase was of particular significance because the consequent funding shortfall made it impossible to accept a bid for the signature span's superstructure, received on May 26, 2004, and due to expire on September 30, 2004. In its report, Caltrans noted the funding problem and asked the Legislature to enable the contract award through a supplement to the program budget. It did not offer suggestions on a source for this additional funding. When the Legislature did not approve new funding by the end

of September 2004, the Business, Transportation and Housing Agency, the state oversight agency for Caltrans, announced that the contract bid had expired and that it was considering rebidding or redesigning the signature span.

SCOPE AND METHODOLOGY

The Joint Legislative Audit Committee (audit committee) requested that the Bureau of State Audits examine the delays and higher cost estimates for the program. Specifically, the audit committee requested that we identify the factors contributing to additional capital and support cost increases, which of these factors were unforeseen at the time that the AB 1171 estimates were prepared, and the extent to which the signature span design independently contributed to costs increases. It also asked that we compare the program's cost increases with those for other large capital projects managed by Caltrans since fiscal year 2000–01, and identify the potential scope, cost, and schedule for any retrofit work Caltrans plans to initiate on the Antioch and Dumbarton bridges. In addition, the audit committee requested that we describe the role of Caltrans and transportation planning agencies in planning, implementing, and managing program costs, examine Caltrans' basis for the program's schedule, evaluate the adequacy of procedures for modifying cost estimates and completion dates, and determine whether Caltrans employs best practices when managing projects that cost more than $1 billion. Finally, the audit committee asked us to determine the extent to which cost increases for the signature span were funded by additional toll contributions, and whether funds appropriated for the program were diverted to other uses.

To comply with this request, we reviewed and evaluated the laws, rules, and regulations associated with the program. Based on these statutes and various interviews with management, we determined the roles that Caltrans and local planning agencies play in planning, implementing, and managing the program's costs. As noted in the Introduction, we reviewed Caltrans' accounting records to ascertain the extent to which program costs will be funded by additional toll contributions and whether funds appropriated for the program were diverted to other uses. We concluded that no funds had been diverted. Additionally, we interviewed Caltrans staff and program management to determine the current status of the seismic retrofit studies for the Antioch and Dumbarton bridges.

We compared the cost estimates prepared under AB 1171 and those supporting Caltrans' August 2004 report and reviewed the methodology for estimating capital and support costs. We focused on the east span of the San Francisco-Oakland Bay Bridge and the Richmond-San Rafael Bridge because these projects accounted for 99 percent of the cost increases for specific bridges. We analyzed cost changes on these projects to determine where significant variances occurred and whether these cost factors were unforeseen at the time of AB 1171. For estimates of capital and support costs with significant increases since AB 1171, we interviewed Caltrans staff and program management and evaluated documentation, such as construction contracts and associated change orders, to ascertain the reasons for the increases. Further, we examined the supporting documentation for Bechtel's August 2004 cost review of the program. Additionally, we compared program cost increases and their causes with those that occurred in similar large projects managed by Caltrans for BATA's measure 1 program. Finally, we reviewed Caltrans' policies and procedures for preparing cost estimates, including those that relate to contingency reserves.

We compared Caltrans' management of the program to project management best practices as described in the *Project Management Body of Knowledge*, FHWA guidance for major projects, and Caltrans' internal project management handbooks, focusing on the management of risk, cost, and communications with external stakeholders. We focused on the East Span because it accounts for the majority of the program's increased cost estimates, although we addressed several issues that affect other projects or the program as a whole. We interviewed Caltrans staff and program managers, and reviewed project documents, analyses, and cost reviews prepared by Caltrans and its consultants. We also interviewed and received documentation from staff and managers of FHWA, the commission, and Bechtel. For risk management, we evaluated Caltrans' risk management planning and its processes for risk identification, quantification, mitigation, and tracking for the East Span. For cost management, we ascertained whether Caltrans regularly prepared program-wide estimates of costs and contingency reserves and kept them updated. Because they have the potential to increase costs above contracted amounts, we also reviewed a sample of large contract change orders for several projects to check for compliance with Caltrans' procedures. For external communications, we ascertained whether Caltrans regularly supplied updated and reasonably accurate reports, incorporating estimates of project costs and contingency reserves, of the status of the overall program, to critical stakeholders—the Legislature, FHWA, and the commission. ■

CHAPTER 1

Volatile Markets for Contractor Services and Materials, Schedule Delays, and Higher Contingencies Led to a Large Increase in Estimated Program Costs

CHAPTER SUMMARY

Various factors have dramatically increased estimated costs for the Toll Bridge Seismic Retrofit Program (program) above the $5.1 billion program budget the Legislature passed in October 2001 as part of Assembly Bill 1171 (AB 1171). Most of the $3.2 billion program increase that the Department of Transportation (Caltrans) presented in its August 2004 estimate relates to the replacement of the east span of the San Francisco-Oakland Bay Bridge (East Span). The uniqueness of the program has made predicting costs an uncertain endeavor. Caltrans indicates that never have such complex bridges been seismically retrofitted, leading a consulting firm hired to perform a cost review of the program to report that traditional highway construction measurements do not apply to retrofitting the East Span. Contributing to the higher cost estimates have been volatile markets for materials and contractor services, which have yielded bids that include higher than expected steel and contractor overhead costs. It is impossible to determine the impact of certain factors because Caltrans' standard contract provisions limit its access to the information supporting contractors' bid prices. It may not disclose such information as it is acknowledged to constitute trade secrets and is not deemed a public record. Also, Caltrans' efforts to increase competition among contractors by extending the bidding period for the signature span's superstructure, and its lengthening of the time allowed for contractors to complete this contract, pushed out the program's completion date by four years. This has increased the period during which Caltrans' support services for these projects will be required and generally escalated cost estimates for future construction contracts. In addition, historical information from completed toll bridge construction contracts and data from outstanding contracts led to increased contingency reserves to cover the cost of known potential risks and unknown risks for individual projects and the overall program.

Caltrans' August 2004 cost estimates were based on accepting a $1.4 billion bid to construct the signature span's superstructure. The bid was allowed to expire, so the beginning of construction will be delayed further as Caltrans considers redesigning or rebidding this component. According to Caltrans in its August 2004 report, failure to accept the bid likely would cause program costs to rise even further.

RISING COSTS AND DELAYS PLAGUE COMPLETION OF THE STATE'S LARGEST PUBLIC SAFETY PROJECT

Caltrans' August 2004 cost estimates for the program were $3.2 billion higher than its estimates in April 2001, including $2.5 billion more related to the East Span.

In its August 2004 report to the Legislature on the program's status, Caltrans disclosed cost estimates that were $3.2 billion, or about 63 percent higher, than the estimates it prepared in April 2001. Caltrans' 2001 estimates formed the basis for the program budget the Legislature adopted in AB 1171. Caltrans' reevaluation of program costs was triggered in May 2004 by receiving the sole bid for the signature span's superstructure, which exceeded Caltrans' 2001 estimate by $930 million. After this event, Caltrans requested that the Metropolitan Transportation Commission (commission) assist in an overall review of the program. The commission then hired a consultant to review Caltrans' estimate of costs to complete the program. In separate August 2004 reports, Caltrans and Bechtel Infrastructure Corporation (Bechtel), the commission's consultant, agreed on a program cost estimate of $8.3 billion, including a $900 million program contingency reserve. Table 3 summarizes the differences between the cost estimates in AB 1171 and Caltrans' August 2004 cost estimates for each of the seven state-owned toll bridges being retrofitted or replaced. As the table shows, the revised cost estimate for individual toll bridges was about $2.8 billion more than the cost estimates used for AB 1171, while the estimated program contingency reserve rose by $452 million. Of these increases, Caltrans estimates that about $2.5 billion relates to higher costs for the East Span. The small variances in costs for the last five bridges in the table were not surprising because these bridges were substantially complete when Caltrans recalibrated the program budget in 2001.

TABLE 3

The Toll Bridge Seismic Retrofit Program Has Experienced Significant Increases in Projected Costs (Dollars In Millions)

Toll Bridges	AB 1171 Estimate	Caltrans' August 2004 Estimate	Projected Cost Increase/(Decrease)	Percentage Increase/(Decrease)
San Francisco-Oakland Bay Bridge				
Skyway	$ 926	$1,490	$ 564	61%
Signature span	830	2,178	1,348*	162
Other East Span projects†	844	1,462	618	73
Subtotals, East Span Replacement‡	**2,600**	**5,130**	**2,530**	**97**
West Span Retrofit and Approach Replacement§	700	737	37	5
San Francisco-Oakland Bay Bridge Totals	**3,300**	**5,867**	**2,567**	**78**
Richmond-San Rafael Bridge‖	665	914	249	37
San Mateo-Hayward Bridge#	190	165	(25)	(13)
Benicia-Martinez Bridge#	190	180	(10)	(5)
Carquinez Bridge#	125	115	(10)	(8)
San Diego-Coronado Bridge#	105	105	0	0
Vincent Thomas Bridge#	62	59	(3)	(5)
Subtotals, Project Specific	**4,637**	**7,405**	**2,768**	**60**
Program Contingency	448	900	452	101
Grand Totals	**$5,085**	**$8,305**	**$3,220**	**63%**

Sources: Chapter 907, Statutes of 2001 (AB 1171), and the Caltrans August 2004 report.

* The signature span projected cost increase is comprised of $930 million related to the sole bid for the superstructure, $146 million related to support costs, $122 million related to increased reserves, $100 million related to other contracts, and $50 million related to miscellaneous items.

† Other projects needed to complete the East Span, including the South, South Detour, Yerba Buena Island structures, Oakland Touchdown, and the demolition of the existing bridge.

‡ The East Span construction is 25 percent complete as of the Caltrans August 2004 report.

§ The West Span retrofit is 100 percent complete and the West Approach construction is 25 percent complete as of the Caltrans August 2004 report.

‖ Bridge retrofit is 85 percent complete as of the Caltrans August 2004 report.

Bridge retrofit is 100 percent complete as of the Caltrans August 2004 report.

Most of the Program's Significant Increase in Cost Estimates and Program Delays Relate to the East Span

More than 90 percent, or $2.5 billion, of the cost increase for specific bridges relates to the East Span replacement project, which has a number of components, including the signature span, the skyway, and the demolition of the existing bridge. The commission chose the signature span design to replace

nearly a quarter of the simpler skyway bridge that Caltrans originally proposed for the entire distance between Oakland and Yerba Buena Island. Figures 1 and 2 in the Introduction show artists' renderings of these two designs. As Table 3 on page 19 shows, although other East Span components saw increases in cost estimates between AB 1171 and August 2004, the most significant was the increase for the signature span, which rose by more than $1.3 billion, or 162 percent. In contrast, the skyway component that remained in the East Span design rose by 61 percent; the remainder of the East Span, composed of 12 components, rose by 73 percent.

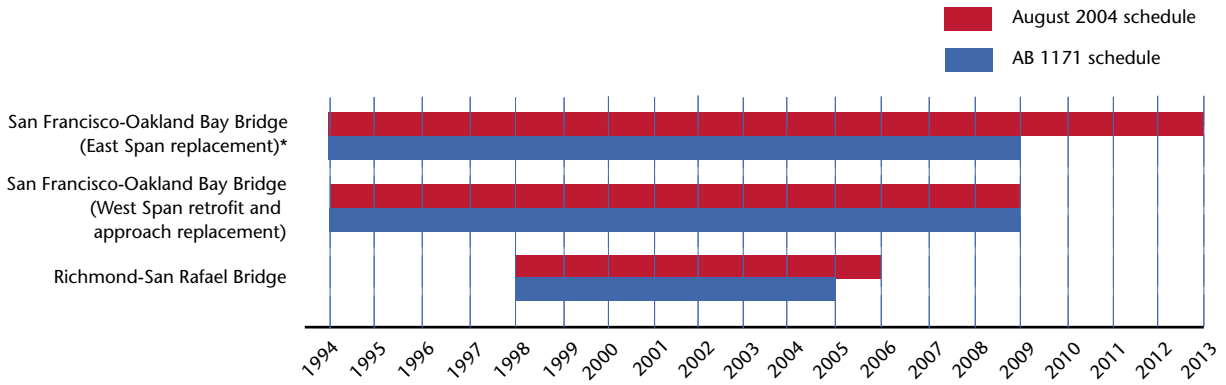
In addition, Caltrans' August 2004 estimates include a $900 million program contingency reserve. Of this amount, $673 million, or 90 percent, of the $750 million in program contingency reserves associated with the capital costs of particular bridges relates to the East Span. Although support costs are not broken out by bridge, based on the fact that the East Span accounts for 90 percent of bridge specific contingency amounts and 90 percent of project specific cost overruns, we believe it is reasonable to attribute 90 percent of the $150 million in contingency related to support costs, or $135 million to the East Span. In total, it therefore appears that the East Span costs, including amounts related to the program contingency, total about $5.9 billion. Of this amount, the signature span cost is $2.6 billion, including $455 million related to the program contingency.

The East Span's estimated cost is $5.9 billion, including its share of the program contingency reserve.

Since 2001, the East Span also has been the source of the program's longest schedule delays. As seen in Figure 3, in August 2004, Caltrans expected the program to be completed by 2013, four years later than it estimated in 2001. This delay can be attributed almost entirely to the signature span. Caltrans postponed the bid opening five times during the advertisement period, delaying the project by almost one year, and agreed to give contractors three more years than it originally envisioned to complete their work. With longer schedules, costs increase because some level of Caltrans' support staff must be retained for the program's duration. In addition, as schedules lengthen, inflation lifts costs in general, and there is more risk of unexpected price increases.

FIGURE 3

Timeline for the Remaining Projects Under Construction



Sources: Caltrans' project plans as of AB 1171 and the Caltrans August 2004 report.

* The timeline for the East Span replacement assumed that Caltrans would accept the sole bid received for the signature span's superstructure in May 2004.

Seismic Retrofit Work Has Proven to Be Difficult to Estimate

According to Caltrans, not only are the toll bridges the largest and most complicated bridges in the State, but nowhere in the world have bridges as complex as these been seismically retrofitted. Furthermore, a consulting firm hired to perform a cost review of the toll bridge seismic retrofit program reported that the proposed East Span is sufficiently unique that traditional estimating metrics for highway construction do not apply. In addition, the joint venture design firm for the Richmond-San Rafael Bridge says it is using retrofit strategies at scales never used before and that circumstances such as these produce a greater degree of cost uncertainty and limit the ability to draw from past experiences and to employ traditional estimating practices.

Recognizing these significant challenges, Caltrans used numerous outside experts and academic advisers when estimating project cost. Under Caltrans' supervision, private consulting firms prepared the cost estimates for all the toll bridges, except for the west span of the Bay Bridge, which Caltrans prepared on its own. Caltrans attributes much of the difficulty in retrofitting the structures to factors such as variable soils and foundations, basing retrofits on seismic forces much

stronger than those the original bridges were designed for, aging structures, heavy traffic volumes, conflicts with utilities, and various environmental concerns. Further, several of the Northern California toll bridges span geologic formations that place some portions of the respective bridges and their foundations in locations of rock and other portions in mud. Also, much of the foundation work is underwater, a condition that Caltrans has found difficult to estimate accurately. All these factors have presented Caltrans with a unique and unprecedented task when estimating project costs.

VARIOUS FACTORS CONTRIBUTED TO THE HIGHER COST ESTIMATES AND DELAYS

Caltrans' limited access to the proprietary data that supports contractors' bids makes it difficult to attribute dollar effects to specific causes.

No one factor alone caused the significant rising cost estimates affecting the seismic retrofitting of selected toll bridges. The multiplicity of factors, along with the limited access Caltrans has to the proprietary data that supports contractors' bids, makes it difficult to attribute dollar effects to specific causes. According to standard provisions in Caltrans' contracts for the program, a contractor must submit to Caltrans all documentary information used in preparation of its bid. The documentation is to be so detailed as to allow for an in-depth analysis of the contractor's estimate. However, Caltrans has only 48 hours after receipt to examine the bid documentation to make sure it is authentic, legible, and includes the necessary documentation to support the bid before sealing it and depositing it in an agreed upon commercial bank for storage. After this point, Caltrans and the contractor may retrieve and jointly review the bid documentation in order to assist in the negotiation of price adjustments and change orders, or to assist in the resolution or in the settlement of claims or disputes. Nevertheless, according to contract provisions, Caltrans agrees to safeguard the bid documentation against disclosure to the fullest extent permitted by law, as it is acknowledged to constitute trade secrets and is not deemed a public record.

These limits on access and disclosure of information are an important reason why Caltrans cannot provide detailed support for the increased costs it attributed to particular factors in its communications with the Legislature in August 2004. Caltrans provided us with its presentation, which included a table of the factors to which Caltrans attributes the program's cost increases. For example, Caltrans cited $200 million in extra costs due to bonding and insurance market changes, $200 million related to limits on competition due to construction industry capacity,

and $525 million related to risks for construction delays. The chief deputy district director over the toll bridge program said that the amounts were based on the professional judgment of program managers and that there was no documentary support that identified the methodology or calculations attributed to each factor. According to its director, Caltrans derived these amounts from construction industry input, Caltrans' structural material escalation indices, steel industry publications, ongoing contractor contacts, and historical toll bridge construction data.

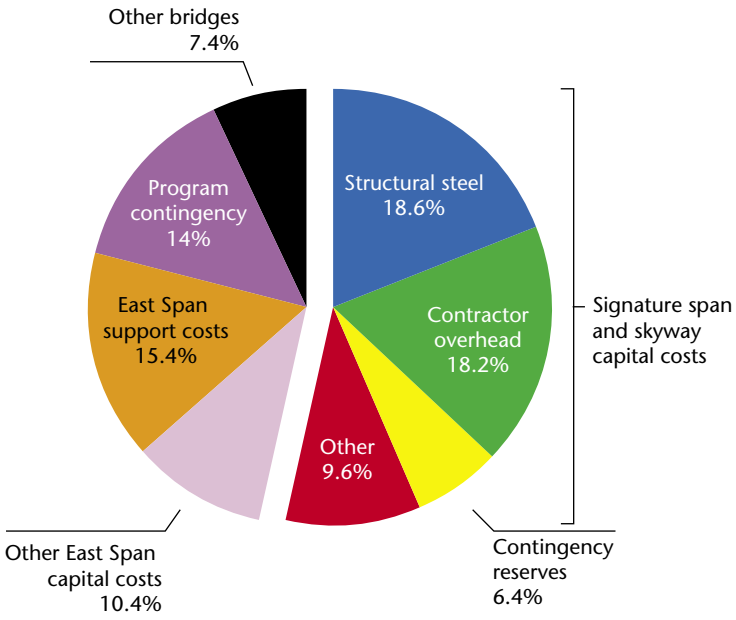
Our analysis suggests that a number of factors, including volatile market conditions and project delays, led to higher cost estimates in 2004.

Nevertheless, comparing Caltrans' two cost estimates, from 2001 and 2004, we found that much of the program's cost increases occurred in several areas such as structural steel, contractor overhead, and support costs. Although unable to fully define the underlying causes of these increases, our analysis suggests that a number of factors, including volatile market conditions and project delays, led to higher estimates. After reviewing these factors, it appears that at the time Caltrans created the estimates for AB 1171 in April 2001, it could not have foreseen issues that explain major increases in cost, with the exception of the lack of full cost escalation.

As part of its planning and design phases, Caltrans or its consultants prepared detailed cost estimates reflecting the materials and services they believed were needed to retrofit or replace each toll bridge. For two parts of the East Span, the skyway and the signature span, and for the Richmond-San Rafael Bridge, we categorized these costs for Caltrans' two estimates—one from 2001, when AB 1171 was passed, and the other from August 2004—and analyzed cost changes to determine where significant variances occurred. Cost categories include those for materials, such as structural steel and precast concrete, as well as intangible costs such as contractor overhead (including mobilization) and Caltrans' support costs. Figure 4 on the following page highlights the categories with the most significant cost increases, showing that five areas—contractor overhead, structural steel, and contingency reserves for the East Span's skyway and signature span; support costs for the East Span; and the program's contingency reserves—account for the bulk of the program's cost increases.

FIGURE 4

Percentage Increase in Various Cost Categories



Source: Chapter 907, Statutes of 2001 (AB 1171), and the Caltrans August 2004 report.

Giving more detail on increases for each of the cost categories we reviewed for the skyway, signature span, and Richmond-San Rafael Bridge projects, Table 4 shows that a few types of costs account for most of these projects' cost increases.

Our analysis points to the following market and project developments that led to higher estimates for these cost categories:

- Higher steel prices.
- Lengthened schedules that increased the need for contractor overhead and Caltrans support, and further escalated costs.
- Escalation that Caltrans did not apply to the entire life of the projects at the time of AB 1171.
- Difficulties with underwater work.
- Recognition of significant continuing risk that led to increased contingency reserves.

TABLE 4

Amounts of Increases in Various Cost Categories (In Thousands)

	San Francisco-Oakland Bay Bridge			
	Skyway	Signature Span	Skyway and Signature Span	Richmond-San Rafael Bridge
Cast-in-place concrete	$ 27,026	$ 52,453	$ 79,479	$ 321
Core concrete/drill and bond/ prestressing	8,683	4,476	13,159	1,878
Environmental preservation	2,286	279	2,565	210
Excavation and cleanup	8,125	136	8,261	21,855
Marine access	NA*	43,000	43,000	NA
Micropiles	NA	NA	NA	14,211
Other materials and services	(72)	10,458	10,386	1,750
Contractor overhead	178,187	406,769	584,956	11,455
Pilings	23,007	5,010	28,017	11,577
Precast concrete	51,647	NA	51,647	1,931
Removal and demolition	NA	1,200	1,200	271
Roadway	(390)	4,284	3,894	NA
Seismic safety	8,757	10,337	19,094	641
Structural steel and miscellaneous metal	99,605	498,332	597,937	35,830
Temporary items	2,186	NA	2,186	253
Traffic control and safety	286	(1,498)	(1,212)	3,082
Utility work and services	2,122	20	2,142	928
Water pollution control measures	(225)	NA	(225)	173
Reserves	85,872	121,623	207,495	107,657
Other items†	761	45,199	45,960	(4,023)
Subtotals, Capital outlay increases	**$497,863**	**$1,202,078**	**1,699,941**	**210,000**
Capital outlay increases other East Span projects			334,000	
Support cost increases for East Span			496,000	
Support cost increases for Richmond-San Rafael Bridge				39,000
Totals, Project Cost Differences			**$2,529,941**	**$249,000**

Sources: Caltrans' April 2001 and August 2004 cost estimates.

NA = Not applicable.

* Marine access was a separate category in the skyway estimate used for AB 1171, but the item was included under the contractor overhead category in the project bid.

† Other items include supplemental work, state-furnished materials, and minor differences.

Volatile Market Conditions Contributed to Cost Increases for Materials

Our analysis suggests that a number of factors, including volatile market conditions and project delays, led to higher cost estimates in 2004.

Caltrans has experienced large increases in the cost of building materials that can be attributed in part to increases in market prices and other less quantifiable factors. The largest materials cost increases are for the more than 60,000 tons of structural steel needed for the signature span's superstructure, with its 525-foot steel tower, deck, and suspension cable. Structural steel items greatly increased from the AB 1171 estimate made in 2001 to the May 2004 contractor's bid.

Projects often face fluctuation in material cost estimates up to the point of locking in contracted amounts. Estimators account for fluctuations related to general price trends by using escalation rates in estimates, but escalation rates do not cover unexpected spikes in market prices. Also, cost increases between estimates and contract bid amounts can be affected by differing estimates of the quantity of materials needed to accomplish particular design objectives, although these do not appear to be significant in this case.

Caltrans saw a $498 million, or 137 percent, increase in the cost of structural steel items for the signature span. Part of this increase is attributable to a significant increase in the price of structural steel in the first half of 2004. According to an industry index that Caltrans engineers use to monitor steel price fluctuations, the industry experienced a 26 percent increase in structural steel prices in the first half of 2004. We applied this percentage to the $365 million in structural steel costs estimated for the signature span under AB 1171 to get a rough idea of its impact on materials costs. This computation yields $95 million in extra structural steel costs.

Although steel prices played a part in rising costs, increases in some bid items are well over what can be explained by a general increase in steel prices. For example, the signature span calls for the building of a steel falsework, identified as "temporary towers" in the bid document, to support deck segments during bridge construction. The temporary towers are designed to hold the signature span in place until the permanent tower is built and the cable suspension for the bridge is in place. Afterward, the contractor will remove the temporary towers. At the time of AB 1171, when the bridge design was about 65 percent complete, Caltrans estimated that this temporary structure would cost $10 million. The 26 percent increase in structural steel prices in the first half of 2004 would increase this estimate

Only $2.6 million of the $205 million increase in cost for the temporary towers can be attributed to the increased price of steel.

by $2.6 million to $12.6 million. When Caltrans' consultant completed the design in April 2002, before the sharp increase in steel prices, it revised the cost to $30 million. In April 2004, after the sharp increase in steel prices, Caltrans' internal estimates indicated that the probable bid amount for the temporary towers would be nearly $70 million. However, in the single bid Caltrans received in May 2004, the signature span temporary towers were estimated at $215 million, far beyond the amount by which higher steel prices would have increased the cost. Of the $205 million difference between the bid and the AB 1171 estimate for the tower, only about $2.6 million can be attributed to the price of steel applied to the initial quantity of steel, as opposed to the quantity of steel, labor to install the steel, risk, profit, or other factors.

We asked Caltrans staff to explain this significant increase, specifically questioning whether a portion could be explained by a difference between the quantity of steel Caltrans' estimated and what the bidder calculated it needed to construct the temporary towers to support the load of the permanent structures. The director told us that, given the load requirements for the temporary towers, the consulting firm Caltrans used to estimate cost and materials requirements verified that its quantity estimates are still valid. Thus, the director indicates that the higher than expected bid amount likely is due to a number of other factors. For example, the bidder may have included in that amount the costs for the heavy equipment used to lift the deck into place, instead of putting those costs in the line items for erecting the related structural steel items. Also, the bidder may have incorporated an amount to reflect the risk related to how long the temporary towers would have to support the permanent work. Further, the director said the contractor's cash flow also might have played a role. Specifically, the bidder may have moved amounts from another line item into the temporary tower line, an early payment line item, in order to receive contract payments earlier than if it had included the amounts in other biddable items.

When we asked Caltrans for other explanations of cost increases, the director said he believes the bidding contractor might have added on a margin to its materials costs to cover other project costs not identified individually in the project's bid items. He said that risks for future significant material escalations, bonding and insurance costs, as well as the perceived risk of the project, might have been included in such a margin. Because Caltrans has limited

Caltrans believes the contractor may have added on a margin to its materials costs to cover other project costs not identified individually in the bid for the signature span's superstructure, but cannot say to what extent such margins affected the overall bid amount.

access to the contractor's detailed cost calculations according to the standard contract provisions Caltrans uses, it cannot say to what extent such margins affected the overall bid amount.

Caltrans Underestimated the Contractor's Overhead as a Share of Construction Costs, but Longer Project Timelines and Delays Also Played a Role in Higher Costs

In estimating costs for the East Span's skyway and signature span, Caltrans underestimated the contractor's overhead as a proportion of total project capital costs. However, delays and extensions to project timelines, which lengthened the period for which administrative services would be needed, also explain part of the increase in these costs. Addenda to the proposed contract for the signature span's superstructure, made in response to Caltrans' meetings with potential bidders, added three years to the time allowed to complete the East Span project.

Typical of bid documents, the signature span and the skyway bids included separate lump sum amounts for time-related overhead and mobilization. Caltrans defines time-related overhead as the daily cost for the contractor's field and home office managerial and administrative staff as it relates to the number of days needed to complete a contract. The field office cost also includes rent, utilities, maintenance, security, supplies, and equipment expenses of the project field office. After a contract is signed, time-related overhead costs may increase or decrease as changes extend or reduce the contract completion date. Contract change orders allow added payment for project delays. Additionally, Caltrans defines mobilization as the cost of moving laborers, tools, construction equipment, construction materials, and incidentals to the project site; establishing offices, buildings, and other facilities necessary for work on the project; and all other costs that must be incurred before beginning work on various contract items on the project site.

The contractors' bids for time-related overhead items for the skyway and the signature span of the East Span were much higher than Caltrans anticipated. For the skyway bid these costs were $208 million, or 235 percent higher, and for the signature span the costs were $243 million, or 501 percent higher, than Caltrans' AB 1171 estimates. The director indicates that Caltrans normally calculates overhead costs as a percentage of capital costs. Further, he indicates that at the time of AB 1171, Caltrans' standard rate for estimating time-related overhead was 5 percent, but it applied a rate of 10 percent to East Span projects because

of the greater risk of the projects. However, rates for time-related overhead for the two projects in the August 2004 estimates, which reflect actual contractor bids for the project, are much higher—20 percent for the skyway and 15 percent for the signature span. Since 2001, the director indicates that Caltrans capped this bid item at a rate of 15 percent. However, he says Caltrans believes that market conditions after September 11, 2001, have led to higher insurance and bonding costs, and greater scrutiny of risk on large projects, which has contributed to higher time-related overhead bid amounts.

Caltrans' estimates for AB 1171 included time-related overhead at 10 percent of capital costs, but bids for the signature span's superstructure and the skyway came in at 15 percent and 20 percent, respectively, of capital costs.

In addition, schedule delays and contract extensions increased time-related overhead. Caltrans pushed out the construction schedule to attract as many bidders as possible and to address the concerns of potential bidders regarding the amount of time given to construct the signature span's superstructure. During the advertisement period of the contract for the superstructure, Caltrans' meetings with potential bidders resulted in 26 addenda to the proposed contract to address issues that contractors raised, such as the level of liquidated damages imposed in the contract, the three-year contract period, and various cash flow issues. Five addenda added more than three years to the time allowed for project completion, increasing the contract length to well over six years. These changes indicate that the signature span's superstructure was more complicated than Caltrans originally envisioned and so could be expected to use considerably more administrative resources. Considering that the addenda doubled the length of time for construction, a large increase in time-related overhead could be expected. For example, once construction was under way on the skyway, delays added 202 days to the time to complete the project as of November 2004, and contract change orders related to the delays added $25 million to time-related overhead.

Additionally, mobilization was a major factor in increased overhead costs for the signature span. Although the mobilization bid for the skyway project came in about as Caltrans expected under AB 1171, it was significantly higher than expected for the signature span. The mobilization amount for the skyway increased $30.8 million from AB 1171 to Caltrans' August 2004 report, an increase that was similar to that for the overall skyway contract. Mobilization represented about 10 percent of skyway capital costs, which is what Caltrans had contemplated. However, the August 2004 signature span estimates include $233 million for mobilization, or nearly 15 percent of overall capital costs, an increase of $187 million

over Caltrans' AB 1171 estimate. The East Span project manager attributed the higher mobilization costs for the signature span to the fact that Caltrans increased contractual mobilization payments to relieve cash flow constraints on contractors and to mitigate the cost of financing; she believed both actions should have resulted in a reduced bid, not an increased one. Additionally, she states that the overall increase in capital costs would translate to a higher mobilization bid due to the payment structure under the contract provisions.

Increases in Estimates for Caltrans' Support Costs Contributed Significantly to Overall Program Costs

Caltrans' support costs, including staff salaries, consultant fees, and other operating costs, account for $556 million, or 20 percent, of the overall cost increases before program contingencies.

Support costs for Caltrans' administration of the program increased significantly between the Caltrans' AB 1171 and August 2004 estimates, accounting for $556 million, or 20 percent, of the overall cost increases before program contingencies. Support costs include such expenses as staff salaries, consultant fees, and other operating costs of administering the construction activities involved in retrofitting the toll bridges. The increased support costs in Caltrans' August 2004 estimate reflect the dramatic rise in the program's capital costs, a key variable in Caltrans' method for estimating its support costs, and time delays. Estimated capital costs increased by 58 percent between April 2001 and August 2004, while estimated support costs have grown slightly more, by 70 percent, over the same time period.

The program's significant timeline delays and extensions also offer an explanation for why support costs, similar to contractor overhead costs, would be expected to increase. The support costs estimated under AB 1171 in 2001 extended through 2007; however, the August 2004 estimate accounts for support costs through 2012. Caltrans will have to retain consultants and staff to support construction during the added five years of the program. Maintaining this workforce can be expensive. For example, Caltrans' expenditures for support costs averaged about $8 million per month for the 12-month period ending in October 2003. Using this same monthly rate over the five-year difference between the AB 1171 and August 2004 calculations could account for roughly $480 million of the $556 million increase in the program's support costs.

Caltrans Underestimated Price Escalation

Caltrans applied an escalation rate to its AB 1171 estimates up to the time that it expected to receive contract bids, but not for the construction phase.

For large construction projects that extend over a period of time, estimates need to build in escalation rates for inflation over a project's life. Caltrans incorporated an annual escalation rate of 5 percent into its AB 1171 cost estimates for components of the East Span, but only to the time when it expected to receive contractor bids. Although cost estimating can never be an exact science, Caltrans knew that the bids it received would reflect that costs for materials and services used for its projects would continue to rise through the construction phase; therefore, one would expect its estimates to include a consideration of escalation through the construction phase. To reflect inflation that would occur during construction, Caltrans should have extended its escalation calculations to cover the expected time to complete these components. For example, AB 1171 estimates prepared in 2001 included $90 million in escalation costs for the signature span through November 2002, when Caltrans expected this structure would take four years to construct. During this period, prices would continue to rise, resulting in extra costs that contractors would be expected to build into their bids. One way to estimate the effect of inflation through the construction period is to escalate total costs through the midpoint of this phase. This gives a rough approximation, avoiding estimation of each year's remaining contract balance. Using this method to escalate the signature span's total capital costs through the mid-point of the expected four-year construction period and using Caltrans' 5 percent escalation rate, we calculate that the AB 1171 cost estimates for the signature span may have been approximately $70 million higher. For the skyway, escalating costs through the mid-point of the expected construction period would have yielded an AB 1171 estimate that may have been approximately $69 million higher than Caltrans' figure.

Similarly, extending the program four years would have had a large impact on capital costs above that which is calculated in the prior paragraph. Further inflating capital cost estimates under AB 1171 for this extension, we estimate that it could account for up to $110 million of the signature span cost increase. These potential costs that contractors can be expected to add to their bid costs help explain some of the otherwise indeterminable cost increases related to structural steel, overhead, and other costs.

Underwater Work Increased Costs for the Richmond-San Rafael Bridge

The retrofit of the Richmond-San Rafael Bridge has faced many obstacles related to underwater work. Underwater debris discovered after construction began, deeper than expected bedrock at several locations, and lack of clearance for driving micropiles have challenged the contractor working on the project. Change orders reflecting these difficulties of underwater work have added $47.6 million to the project's costs.

Caltrans accumulated $47.6 million in additional costs related to underwater work on the Richmond-San Rafael Bridge, including $22 million to remove underwater debris.

According to the retrofit project manager for the Richmond-San Rafael Bridge, Caltrans hired a consulting firm during the project's design phase to conduct geotechnical test borings, mostly to determine the depth and thickness of the bedrock base. However, the extent to which this base varied was not discovered until work began. Also, the test borings were not designed to detect buried debris left over from the original bridge. Further, he stated that without demolishing existing pile caps it would have been impossible to determine the actual placement of existing underwater piles, or supports. These conditions ultimately hindered completion of the project. As of mid-June 2004, Caltrans had accumulated about $22 million in approved or pending contract change orders related to the removal of underwater debris, most of it, according to the retrofit project manager, left behind when the bridge originally was constructed. This debris was not on the as-built plans for the bridge and was located primarily below the mud line over the length of the project. The engineers on the current retrofit project did not become aware of the problem or its extent until Caltrans conducted a detailed diving inspection of the piers after construction began. The retrofit project manager told us that Caltrans did not expend the resources to conduct a diving inspection as part of the design phase because it did not anticipate the types of problems discussed here and because the debris was not shown on the as-built plans.

Also, conditions related to the piling work on the Richmond-San Rafael Bridge have resulted in a number of project change orders, totaling roughly $11.6 million. According to the retrofit project manager, the contractor has had difficulty with some of the piling work because they discovered that soil conditions and bedrock depth varied considerably over short distances, creating the need to shorten or lengthen piles. To minimize delays that could prolong the job, Caltrans has agreed to pay for much of the added costs, including additional labor shifts, needed to

complete the work. Caltrans had conducted geotechnical work in the design phase, which included 20 test borings, but these efforts did not uncover the extent of the ground variance.

Finally, the installation of underwater micropiles has continued to cost more than anticipated. According to the retrofit project manager, Caltrans knew that if the original bridge piles were driven according to plan, the contractor would have only four inches of clearance for driving the micropiles. However, the contractor found that some of the original bridge piles had not been driven straight into the bedrock, but were sitting at odd angles, which eliminated the small amount of clearance needed to drive the new micropiles. Consequently, Caltrans sometimes had to pay the contractor for redesigning and redriving the micropiles, a significant amount of extra work for the contractor. Change orders related to micropile work have cost Caltrans more than $14 million over contracted amounts.

The Program's Contingency Reserves for Potential Cost Increases Remain High

Part of the anticipated $3.2 billion increase in the August 2004 estimates include contingency reserves to cover potential costs related to the program's unique estimating challenges. Caltrans looks to its contingency reserves to cover unforeseen costs and potential claims related to identified problems, generally establishing a contingency reserve for each project and sometimes a program-wide contingency reserve. In its August 2004 cost estimates, Caltrans established contingency reserve amounts for the skyway, signature span, and the Richmond-San Rafael Bridge that are significantly higher than contingency reserve levels of more typical projects, reflecting the greater amount of risk these projects have for schedule delays and cost overruns.

In August 2004, estimated contingency reserves for the skyway, signature span, and Richmond-San Rafael Bridge were significantly higher than for more typical projects.

Compensating for the limited information available during the planning phase of a project, allocations for contingency reserves start high, and then generally decrease as funding is transferred from them to identifiable cost categories. At project completion, amounts remaining in the reserve represent the extent to which a project has been completed for less than the budget or cost estimate. Following this logic, Caltrans' policy dictates that reserves should range from 30 percent to 50 percent of project costs in the conceptual stages of a project. Once a project is approved and progresses into its planning and design phases, the contingency reserve percentage is reduced. By the time a project is advertised for bid, contingency reserve levels normally

are reduced to about 5 percent of the project's cost. Caltrans' policy states that any percentage higher than this must be justified based on the atypical nature of the project.

As shown in Table 5, the contingency reserve amounts that Caltrans built into its August 2004 cost estimates for the skyway, signature span, and the Richmond-San Rafael Bridge remain substantial, sometimes even above AB 1171 cost estimates in terms of the percentage of capital costs they represent. The project contingency reserves are also significantly higher than contingency reserve levels of more typical projects under normal Caltrans guidelines. In August 2004, the skyway and the Richmond-San Rafael Bridge were under construction and Caltrans had received a bid for the signature span's superstructure. As discussed earlier, normal policy indicates reserves of 5 percent or less in these circumstances. According to its director, Caltrans estimated additional contingency reserve amounts for the projects not yet completed based on data derived from contracts currently in or not yet under construction, as well as historical information from completed toll bridge construction contracts.

The $900 million contingency reserve represents the level Bechtel concluded was necessary to provide an 80 percent assurance that costs would not exceed Caltrans' August 2004 cost estimate.

Further, in August 2004, Caltrans estimated that it needed a $900 million program contingency reserve based on the results of a probabilistic risk analysis model for construction costs used by Bechtel. The model included significant components related to work not yet completed that could affect the outcome of the program, such as contract work not completed; contract work not yet awarded; unresolved changes and claims; potential changes, claims, and delays; and escalation. Bechtel assigned probability values ranging from 10 percent to 90 percent to the terms in the model, and then ran 2,000 iterations of the model to develop a probabilistic outcome. The $900 million reserve level that came out of this process represents the reserve level Bechtel concluded was required to provide an 80 percent likelihood the program cost estimate will not be exceeded. In addition, Bechtel performed a schedule risk analysis for construction and applied a program contingency to support costs.

For the risk analysis model, Bechtel drew not only on Caltrans' experience with the toll bridge seismic retrofit program, but also from its own role in monitoring and reporting bridge and highway improvement projects funded under the Bay Area Toll Authority's (BATA) Regional Measure 1 (measure 1) program. In its role on the measure 1 program, providing project monitoring services, Bechtel has become familiar with Caltrans' difficulties

TABLE 5

Reserves for Major Projects and the Program Remain High (Dollars In Millions)

	Estimation Point	Reserves as a Percentage of Estimated Capital Cost	Amount of Reserves	Project Stage
Richmond-San Rafael Bridge				
	AB 1171	19.3%	$110.2	4 percent of retrofit
	August 2004	27.9	217.9	85 percent of retrofit
Skyway				
	AB 1171	12.4	98.5	100 percent of design
	August 2004	14.3	184.3	55 percent of construction
Signature Span				
	AB 1171	20.6	146.3	65 percent of design
	August 2004	14.0	267.9	Bid received
Program				
	AB 1171	11.7	448.0	Major East Span contracts not bid
	August 2004	14.9	900.0	Skyway at 55 percent of construction, bid received for superstructure of signature span

Sources: Consultant-prepared cost estimates and Caltrans' August 2004 cost estimates.

with other toll bridge construction in the Bay Area, including significant cost and schedule impacts associated with foundation work in water. For example, the new Benicia-Martinez Bridge, currently under construction, has experienced cost overruns of nearly 81 percent over its June 2000 budget, rising from $586 million to nearly $1.1 billion as of September 2004. Similar to the Richmond-San Rafael Bridge, the Benicia-Martinez Bridge has had many difficulties with underwater construction work, which account for most of this cost increase, according to Bechtel's project monitoring reports to BATA. For example, Bechtel's May 2004 report notes that the project experienced problems such as installing foundation rock sockets, mitigating the effects of pile driving on fish, and driving piles to the required elevation. Caltrans experienced smaller cost increases on the west span replacement for the Carquinez Bridge, another

measure 1 project, which saw an increase of 18 percent above its June 2000 budget, increasing from $433 million to $512 million as of September 2004.

With Continuing Uncertainties, the Program's Costs May Rise Further

Despite the significant increase in the program's estimates, costs could go even higher, according to August 2004 reports by Caltrans and by Bechtel. The August 2004 estimates assumed that Caltrans would accept the bid for the signature span's superstructure and thus keep the program on schedule. In its report, Caltrans stated that if the bid expired, it would have to readvertise and rebid the superstructure, possibly resulting in a one-year schedule delay and a significant escalation of costs. As discussed in the Introduction, the bid expired and the Business, Transportation and Housing Agency, the state oversight agency for Caltrans, announced that it was considering rebidding or redesigning the signature span. In August 2004, Bechtel indicates it reviewed Caltrans' analysis of bid options for the superstructure, which indicated that project costs would increase if the superstructure was readvertised and rebid, or redesigned. Specifically, Bechtel concurred with Caltrans that rebidding the superstructure using the same design could increase project costs in a range from nothing to as much as $200 million. Similarly, Bechtel agreed with Caltrans' analysis that redesigning this component of the East Span as a typical cable-stayed bridge could save the program $85 million but also might increase program costs by $310 million, depending on time delays that Caltrans estimated could range from two-and-a-half to four years.

Because the bid for the signature span's superstructure has expired, Caltrans will have to rebid or redesign this component of the East Span.

Bechtel was careful to say that its review was not a detailed estimate of program costs and that it did not perform a value engineering analysis. Further, Bechtel stated that Caltrans and BATA provided the information used in its evaluation, but that it did not independently verify that information. Rather, Bechtel's cost review was a trend analysis of the current Caltrans' forecasted cost for the program based on individual project contracts. Bechtel also performed a pricing validation on the East Span contracts not yet awarded, completed cost risk and schedule risk analyses, and evaluated the program's contingency reserve.

According to the commission, in September 2004, Caltrans, with a preliminary review by Bechtel, developed a cost estimate for rebidding a skyway design to replace the signature span. Before considering other factors such as schedule delays and

the cancellation and modification of existing contracts, this estimate indicates that a skyway design would cost $665 million less than the signature span. According to the commission, Caltrans estimated that costs associated with the other factors would, however, largely off set this gain, yielding either savings of $255 million or additional costs of $140 million. The cost that Caltrans may have incurred to build a skyway over the span that is now the skyway plus the signature span cannot be known with certainty. Even if Caltrans had requested bids for the skyway that it initially recommended, the amount of change orders to the contract would not be known. However, Caltrans' September 2004 estimate of the capital cost for building an additional section of skyway instead of the signature span indicates this section of skyway would cost $935 million, which is $665 million less than Caltrans' current estimated capital cost for the signature span, without project contingency reserves. This portion of the skyway would thus cost about $1.51 million per meter versus a cost of $523,000 per meter for the current skyway. According to the commission, Caltrans' higher cost estimate accounts for a number of factors, such as deeper marine foundations, rock interface for foundations, longer spans and taller pier columns, that would make the unit cost of building this particular section of the skyway more expensive than the unit cost of the skyway project that is currently under construction. The $665 million savings may, however, be lower than the savings that an earlier decision to choose the skyway design would have generated. Caltrans' estimate reflects today's prices, which are higher than those that would have applied in earlier periods. In addition, Caltrans' estimate does not include savings for project and program contingency reserves or support costs even though the skyway structure is less complex than the signature span.

On December 10, 2004, Caltrans published a study that recommended either completing the signature span as originally designed or extending the skyway across the East Span. Caltrans' study included a range of total costs for each option. We requested the schedules supporting Caltrans' cost figures, as well as its reconciliation of the cost figures to its August 2004 report to the Legislature. However, because we had already sent a draft report to Caltrans for its review and comment, and because we did not receive the schedules from Caltrans with sufficient time to review them prior to publishing this report, we were unable to analyze the cost figures in this study. ■

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CHAPTER 2

Caltrans' Project Management Practices Need Improvement

CHAPTER SUMMARY

The Department of Transportation (Caltrans) has neglected several important aspects of project management that could have helped it maintain realistic and up-to-date estimates of program costs and risks, and communicate those estimates in a timely manner. As shown in the last chapter, Caltrans Toll Bridge Seismic Retrofit Program (program) has been threatened by sharp increases in cost estimates and major schedule delays. Although the full extent of the program's financial crisis became apparent only in August 2004, when Caltrans presented its new cost estimate to the Legislature, Caltrans had numerous earlier indications that the program would exceed the Assembly Bill 1171 (AB 1171) budget.

Although it hired consultants to analyze project risks and acted to mitigate some risks associated with the unprecedented San Francisco-Oakland Bay Bridge east span (East Span) project, Caltrans did not develop a comprehensive risk management plan for this project. Our review of project risk management focuses on the East Span because this unique project accounts for $2.5 billion of the $3.2 billion cost overrun and four-year schedule delay, discussed in Chapter 1. Although Caltrans identified certain risks through various analyses, it has not performed some of the major processes—planning, tracking, and quantifying—necessary to maximize the chances of positive rather than adverse events in the East Span project. Also, Caltrans did not quantify the potential dollar costs to the project of various risks until August 2004, when it reported soaring cost estimates to the Legislature. Although the East Span project began in 1998, Caltrans states that it now intends to enhance its risk management process and create a risk management plan for the project.

Caltrans also has not followed generally accepted cost management practices to help ensure that the project could be completed within its 2001 budget in AB 1171. Caltrans did not regularly update its cost estimates for the East Span project or the entire program, including updating estimates for

capital costs, support costs, and contingency reserves, which should cover the cost of known potential risks and unknown risks. Without updated cost estimates, Caltrans cannot give program managers a detailed overview of the program's capital and support costs for all the bridges. Because Caltrans did not regularly update the projected costs for the program, it could not assess whether it was staying within budget. Had it been monitoring the program's costs regularly, Caltrans would have realized much earlier that the program was exceeding its budget under AB 1171.

Caltrans issues contract change orders for various reasons, such as adjusting contract plans or having a contractor do extra work. We reviewed a sample of 20 large change orders and found that Caltrans complied with its internal policies and procedures.

Finally, Caltrans has not paid enough attention to communications management, failing to inform its major stakeholders such as the Legislature and the Metropolitan Transportation Commission (commission) of potential cost overruns. Although state law requires periodic status reports to the Legislature, Caltrans provided no reports for time periods after 2002 until August 2004. Caltrans had strong indications that the program's costs would exceed the AB 1171 budget as early as November 2003, when it provided an annual financial plan update (financial plan) to the Federal Highway Administration (FHWA). However, this financial plan did not reflect Caltrans' internal cost estimates, so it understated the extent of the program's financial risks. By failing to disclose cost overruns until long after it became aware that the program likely would exceed its budget, Caltrans placed the Legislature in the awkward position of having to try to devise a funding solution six weeks before the bid on the most expensive component of the East Span project, the signature span's superstructure, was set to expire. Also, by not providing timely information to the commission or the Bay Area Toll Authority (BATA), Caltrans ignored critical stakeholders who represent the San Francisco Bay Area (Bay Area) on transportation planning issues.

THE *PROJECT MANAGEMENT BODY OF KNOWLEDGE* DESCRIBES IMPORTANT MANAGEMENT PRACTICES

The Project Management Institute, recognized for its development of standards for the practice of project management, publishes the highly regarded *A Guide to the*

Project Management Body of Knowledge (*PMBOK Guide*), which identifies and describes generally accepted project management practices. The *PMBOK Guide* defines nine knowledge areas that organizations must manage in every project to ensure successful completion: integration, scope, time, cost, quality, human resource, communications, risk, and procurement. We focused our review on three areas of project management: project risk, cost, and communications management.

Caltrans recognizes the importance of the *PMBOK Guide*: its project management handbook emphasizes the nine knowledge areas and often cites the *PMBOK Guide*. Caltrans' departmental project management policies have incorporated all the knowledge areas since before the inception of the program, with its 1997 handbook acknowledging that understanding and applying those areas to a project is crucial to delivering a successful project. In 2003, Caltrans further emphasized the importance of applying the *PMBOK Guide's* project risk management guidelines and its project communication management guidelines when it published separate handbooks for its project managers on each knowledge area.

BY NOT CONSISTENTLY FOLLOWING RISK MANAGEMENT BEST PRACTICES, CALTRANS HAS NOT ADDRESSED THE EAST SPAN PROJECT'S RISKS ADEQUATELY

Caltrans did not create a risk management plan to define how it would identify, prioritize, quantify, respond, and track risks for the East Span project.

Even though Caltrans has acknowledged that risk management is an essential component of project management, it has not focused sufficiently on managing the risks of the East Span, including the self-anchored suspension component, or signature span. Caltrans did not create a risk management plan to define how it would identify, prioritize, quantify, respond, and track risks for the project. Although Caltrans identified certain risks and opportunities through quality assurance, risk analyses, and information sessions with potential suppliers, steel fabricators, and contractors, Caltrans has not performed some of the major processes—planning, tracking, and quantifying—necessary to maximize the chances of positive rather than adverse events in the East Span project.

Although successfully working to mitigate some of these risks and achieve project objectives, Caltrans also identified numerous, significant risks to the project that it did not quantify in terms of potential added costs. Further, Caltrans did not estimate the potential costs associated with project risks and

then sufficiently update estimates of reserves it needed on the East Span project based on an analysis of its experience with other Bay Area bridge projects.

The *PMBOK Guide* observes that risk management processes must be commensurate with the project's risk and importance to an organization. With its unique and unprecedented design and high cost, the East Span has extraordinary strategic, technical, and financial risks. Also, the success or failure of the East Span significantly affects Caltrans' reputation as well as its ability to complete an essential public safety program. Caltrans' project risk management handbook (risk management handbook), published in June 2003, cites that project risk management is most effective when first performed early in the life of the project and is a continuing responsibility throughout the project.

Risk Management Processes According to the *PMBOK Guide*

1. **Risk Management Planning**—deciding how to approach and plan the risk management activities for a project.
2. **Risk Identification**—determining which risks might affect the project and documenting their characteristics.
3. **Qualitative Risk Analysis**—performing a qualitative analysis of risks and conditions to prioritize their effects on project objectives.
4. **Quantitative Risk Analysis**—measuring the probability and consequences of risks and estimating their implications for project objectives, including determining the size of cost and schedule contingency reserves that may be needed.
5. **Risk Response Planning**—developing procedures and techniques to enhance opportunities and reduce threats to the project's objectives.
6. **Risk Monitoring and Control**—keeping track of identified risks, monitoring residual risks, identifying new risks, ensuring the execution of risk plans, and evaluating their effectiveness in reducing risk.

Although Caltrans Has Some Risk Management Activities in Place, It Lacks a Comprehensive Risk Management Plan

Contrary to generally accepted practices and its risk management handbook, Caltrans did not create a risk management plan for the East Span. Risk management involves six major processes that include risk management planning (see textbox). A risk management plan describes how these processes will be structured and performed during the life of the project. According to the *PMBOK Guide* and Caltrans' risk management handbook, such a plan defines various risk management processes and how often they will be used throughout the project, so that results of risk analyses can be developed early enough to affect decisions. Both the *PMBOK Guide* and the risk management handbook cite the importance of a risk management plan that enables Caltrans to identify, assess, quantify, prepare responses to, monitor, and control project risks. However, Caltrans did not formalize its risk management activities, nor did it establish how they would be documented and tracked through the life of the project. As a result, the East Span project has lacked the solid risk management foundation that a documented and working plan could provide. According to its director, Caltrans is completing documentation for a comprehensive

risk management plan for the East Span project. Further, the director indicates that elements of this plan will include risk identification, mitigation strategy, history of risk management, a schedule of regular risk analysis on the contracts, and identification of the group responsible for implementation of this plan.

For our benefit, in October 2004 Caltrans put together a summary that is supposed to be the risk management plan for the East Span project. This summary includes primarily a historical description of methods Caltrans used to identify risks, and names of individuals who are a part of its Project Quality/ Risk Assessment/Oversight Group (risk assessment group). However, the summary omits how Caltrans will perform key risk management processes the *PMBOK Guide* deems critical to successful risk management and that Caltrans' own handbook prescribes. For example, the summary does not define how Caltrans will identify and quantify risks throughout the life of the project and how risk activities will be documented and tracked. Moreover, Caltrans created this summary especially for us, so it was not actually used as the plan to manage the East Span project's risk.

In a February 2003 report, a consulting firm Caltrans hired to perform a quality assurance check and risk assessment of the estimated construction schedule for the East Span, warned that the East Span project's complexity and uniqueness warranted an increased risk management effort. The consultant concluded that Caltrans and the commission should have a workable risk management system in place and continually monitor the risk profile. Further, the consultant stressed that an essential part of risk mitigation for the project would be to form a risk management team fully dedicated to this project that not only manages risks associated with the signature span, but also coordinates and manages risks for the overall project. Moreover, the consultant warned that if a risk management team and other mitigation strategies for technical issues were not implemented, it was highly unlikely that Caltrans could complete the East Span by the then-expected completion date of 2008. For example, a risk noted in the February 2003 report was that customary Caltrans' procedures lacked formal management and control processes to coordinate the overlap between the steel deck shop drawing preparation, submittal, and approval task with the fabrication of the signature span's steel deck. It recommended that Caltrans develop several quality assurance procedures to mitigate this risk and that

In a February 2003 report, a consulting firm Caltrans hired warned that if a risk management team and other mitigation strategies for technical issues were not implemented, it was highly unlikely that Caltrans could complete the East Span by the then-expected completion date of 2008.

Caltrans assign oversight authority for this and other procedural matters to the risk management team. Another risk cited by the consultant related to Caltrans using multiple contracts for the East Span project. Caltrans did this to improve competition and potentially increase the number of bidders, but the consultant pointed out that the use of multiple contracts introduced risks for delays and that additional coordination and communication procedures to mitigate these risks should be overseen by the risk management team.

In response to the consultant's recommendation to create a dedicated risk management team for the East Span project, the East Span project manager indicates that the risk assessment group is responsible for risk management for the project and that a group of managers, called the "level 4 group," meets quarterly to identify and discuss mitigation strategies for construction risks related to the East Span. The members of the risk assessment group are important stakeholders—individuals who are actively involved in, exert influence over, or are affected by the project—who should be consulted regarding identifying risks and project risk status. Caltrans indicates the risk assessment group provides the following areas of expertise: improving contract administration practices; enhancing policies, procedures, and products; encouraging streamlined resolution of issues; and assessing and implementing project direction and changes. Further, the East Span project manager states that the risk assessment group and Caltrans' executives have an ongoing active role in the project.

Caltrans did not undertake planning for all the processes that best practices dictate are needed to manage risks.

Having these groups is a good first step in addressing risk management issues for the project; however, neither group undertook planning for all the processes that best practices dictate are needed to manage risks. For example, the risk assessment group does not plan how risk management activities will systematically address risk identification, quantification, or tracking over the project's life. The East Span project manager stated the risk assessment group has biweekly videoconferences as part of a larger group that includes Caltrans' chief engineer, executives, and project team members. She indicates that the purpose of the videoconferences is to evaluate and resolve identified schedule and cost risks. However, agendas for these videoconferences indicate that, although risks are discussed as part of the meetings, Caltrans did not develop the systematic methods of risk planning, identification, prioritization, quantification, and tracking to ensure that its risk management activities are effective. The group discusses individual risks, but

there is no system in place to track these risk discussions. In fact, of the 29 videoconferences Caltrans held from January 2003 through September 2004, only four times in early 2003 did Caltrans distribute meeting minutes to attendees that reflected agreed upon tasks and decisions made. Up to January 2003, the East Span project manager indicates that Caltrans used a status report to record action items from these discussions; beginning in January 2003, she provided us agendas with her handwritten notes as the record of action items. However, the East Span project manager's handwritten notes are not organized in any fashion to show the importance of issues or how Caltrans tracked them. Of the eight meetings that the East Span project manager indicates the "level 4 group" held between December 2002 and September 2004, she provided minutes to four of those meetings and the agenda to another meeting. Although these meetings show that the group discussed various construction issues related to the East Span, the issues were not considered in terms of risk to the project nor were there any discussions related to quantifying risks. Further, none of the minutes give any indication that the group considered the effects of these risks on the program's budget. Also, similar to the risk assessment group, the minutes and agenda do not track the status of risks, but rather are a historical record of the events that were discussed or to be discussed.

Caltrans used a status report to track risk activities, but stopped using it in January 2003, even though one of the action items in the report was to develop and maintain this program-wide status report to update issues and action items.

Further, best practices say that organizations should track identified risks to ensure that they are mitigated. The East Span project manager indicates that Caltrans used a status report to track risk activities, but that Caltrans stopped using the project status report in January 2003. Samples of the status report that Caltrans provided us listed various action items and target completion dates, along with an assessment of whether a risk affected cost or schedule (or both), and whether the item was a low, medium, or high risk. Ironically, one action item identified in the September 2002 status report was to develop and maintain this program-wide status report to update issues, status, action items, responsible persons, and due dates. Since then, the East Span project manager stated that the agenda and minutes of the biweekly videoconferences attended by Caltrans executives and the risk assessment group replaced this status report. However, as noted previously, the discussions of risks and action to mitigate them resulting from these meetings are not tracked, as Caltrans kept minutes for only four of the 29 videoconferences. Moreover, the agendas are merely a

historical record of the issues to be discussed and are not a tool that systematically tracks the status, response, and resolution to identified risks.

Finally, one of the nine members of the risk assessment group that Caltrans identified, the FHWA Bay Bridge project oversight manager, said she had never been invited to attend a biweekly meeting and was not aware of being listed as a member. She indicated that she attends meetings on a variety of topics to keep up with project status and noted that issues related to evaluating and resolving schedule and cost risks are certainly part of any discussion. However, she said that Caltrans never specifically asked her to assess risks for the East Span project. Rather, her role on the project primarily relates to oversight, as opposed to risk management. She indicates she also participates in the project analyses because FHWA approval is required on designs and changes to project designs, and contract change orders.

Caltrans Took Steps to Identify, Prioritize, and Mitigate Project Risks

Despite Caltrans' lack of comprehensive risk management plan, it took several steps to systematically identify, rank, and respond to the East Span project's risks. It initiated five project analyses that discussed project risks and recommended mitigation steps during 2002 and 2003, as noted on the timeline in the Appendix. Also, it followed many of these recommendations on reducing the project's risks. For example, it acted to reduce the risk from steel price increases, mismatched steel parts, and federal regulations requiring the use of domestic suppliers. These analyses represent proactive steps that Caltrans took to identify, prioritize, and mitigate risks.

A March 2002 constructibility review study detailed 103 recommendations addressing specific issues with construction plans and specifications.

In March 2002, a Caltrans consultant performed a constructibility review study to identify errors, omissions, and inconsistencies in its construction documents and specifications, as well as to develop ways to improve contractors' ability to construct the project. Among other things, Caltrans specifically asked its consultant to address the effect of federal regulations on the project, the steel market, steel fabrication, contractors' bonding capacities, and construction market conditions. The study contained detailed recommendations on 12 major issues affecting the East Span, as well as 103 recommendations addressing specific issues with the construction plans and specifications. For each of the 103 recommendations, the consultant provided an assessment of the potential cost to the project.

Following these recommendations, Caltrans began addressing risks identified in the March 2002 analysis. For example, the consultant recommended that Caltrans develop a flexible bidding process because of construction market conditions and to attract competitive bids for the signature span. Caltrans followed the consultant's recommendation by breaking the signature span into three smaller contracts, thus opening up the project to a greater number of contractors to maximize the number of bids received. At this time, Caltrans took steps to mitigate the risks regarding the price and quantity of structural steel needed for the signature span. In March 2002, it conducted an information session to get feedback from suppliers, potential contractors, and fabricators and to help them better understand the project. Then, in August 2002, a Caltrans consultant issued a mock bid report, which evaluated alternatives to an all-steel structure for the signature span as well as conducted a comparison of domestic and foreign steel prices.

A December 2002 quality assurance review recommended that Caltrans increase the cost estimate for the signature span to $800 million to better reflect unknowns.

Caltrans also initiated a quality assurance review by the Caltrans Central Region (Central Region), issued in December 2002, that primarily analyzed the cost estimate for the signature span and secondarily focused on the remaining East Span contracts not under construction. The Central Region contacted 22 contractors and steel fabricators and analyzed eight other Bay Area seismic retrofit projects to examine trends in cost overruns, contract change orders, and unit pricing. The Central Region concluded that major items contributing to the contract cost were the contractor's financing of the project, fabrication of steel, profitability of the contractor, and project risk. To address these concerns, the Central Region submitted 11 specific recommendations and an overall recommendation to increase the project cost estimate to $800 million, to better reflect unknowns in the construction and steel fabrication industries. The Central Region also recommended that Caltrans pursue a waiver of the federal regulations requiring use of domestic steel, which it claimed would have a substantial effect on costs for the steel tower and other components.

As discussed previously, Caltrans engaged a consultant in February 2003 to provide a quality assurance check and risk assessment of the estimated East Span construction schedule. This review was intended to help Caltrans and state officials make critical construction and management decisions necessary to advertise and award the signature span contract. The assessment identified and ranked risks that could affect the signature span's timely completion. The most significant

schedule risk the report identified was that parts might not fit together properly because bidders likely would need to rely on several steel producers and fabricators if the project used steel only from domestic producers. Caltrans addressed this concern and the concern identified by the Central Region by adding provisions to the request for proposal allowing contractors to provide two cost estimates for signature span bids—one price using domestic steel and one using foreign steel. When federal funding is involved, federal regulations require that projects buy steel from domestic sources, unless the cost of domestic steel is more than 25 percent higher than the cost of foreign steel. In the single bid Caltrans received for the signature span in May 2004, the contractor's two prices were sufficiently different to show that federal regulations requiring domestic steel could be waived because the difference in contract price between the two prices exceeded 29 percent of the contract amount, potentially saving $400 million had the international steel bid been accepted for construction.

To lessen the risk of steel price increases, Caltrans obtained a waiver of federal regulations that require the use of domestic steel.

The February 2003 risk assessment also identified structural risk issues for the signature span's components: the foundations, piers, tower, bridge deck, and cable system. For example, the consultant believed that the main cable specified for the signature span could be produced only by a foreign company unlikely to sell its competitors the unique casting mold for making the wire. To address this issue, Caltrans obtained exemption to the federal regulation requiring domestic suppliers for the signature span's main cable.

Moreover, in October 2003, Caltrans formed an independent review committee of consultants, chaired by the former executive director of the Utah Department of Transportation, to review the contract requirements for two major East Span contracts—the signature span and its foundations—before advertisement. Among other tasks, the committee reviewed bidder inquiries for the contract, interviewed selected prospective contractors and fabricators, and assessed a variety of current and future market conditions. Of the 21 recommendations the committee issued in its November 2003 report, it believed five could have a major impact on the actual bid prices. Once again, the waiver of federal regulations requiring the use of domestic steel for the signature span was cited as a mitigation step that could save $50 million to $100 million.

Each of the five major analyses that Caltrans initiated were appropriate actions to identify risks. Further, the analyses recommended steps Caltrans could take to mitigate these risks. However, as the next section indicates, Caltrans did not adequately quantify risks related to the East Span.

Caltrans Did Not Adequately Quantify Risks Associated With the Project

Although Caltrans acted to identify, qualitatively analyze, and mitigate risks that could affect the East Span, it did not have a coordinated risk management plan in place to ensure that it quantified risks in terms of increased costs to the project. The *PMBOK Guide* states that organizations should perform quantitative risk analysis to estimate potential costs associated with project risks. Further, Caltrans' risk management handbook strongly recommends that project managers perform quantitative risk analysis on projects with extremely high risk to estimate the probability of meeting project cost and time objectives. The five analyses discussed in the previous section identified significant risks that could affect the cost and schedule of the East Span. By quantifying the potential cost effect on the East Span's budget, Caltrans could have better gauged the likelihood of staying within the AB 1171 budget.

Three of the five analyses Caltrans initiated quantified risk in terms of potential cost; however, Caltrans did not use these quantified risks to update its cost estimates.

Three of the five analyses quantified risk in terms of potential cost that Caltrans could have used to update its estimates. However, Caltrans did not use these quantified risks to update its cost estimates. For the other analyses, Caltrans did not ask for a determination of the potential cost related to identified risks. According to the director, the cost update for Caltrans' August 2004 report included its first program-wide cost update since Caltrans prepared the cost estimates for AB 1171 in April 2001. After AB 1171 became law, the director said that Caltrans managed to the budget as set forth in the bill by mitigating potential risks. Further, according to the summary of risk actions Caltrans prepared for us, the Bechtel Infrastructure Corporation (Bechtel) August 2004 cost review was the only program-wide quantitative risk analysis performed for the program since AB 1171 was passed. However, Caltrans could have attempted to estimate potential cost increases as at least some of the risks were likely to continue to threaten the project despite efforts to mitigate them.

Moreover, Caltrans' consultant evaluated risks for the February 2003 risk assessment in terms of possible delays to the schedule, and Caltrans did not attempt to estimate costs associated with such delays. As indicated in the summary created especially for us of Caltrans' risk management activities, Caltrans did not attempt to estimate increased costs these risks may pose to the project until the commission hired Bechtel to produce a cost review report released in August 2004. At this time, Caltrans was able to estimate that a one-and-a-half year delay to the project would increase costs by as much as $320 million, including $120 million in support costs and $200 million in additional contractor costs. This indicates that Caltrans had the ability to analyze other areas of the program and calculate potential cost increases. With its engineering expertise or with the assistance of a contractor, Caltrans could have attempted to quantify the additional costs associated with schedule delays before August 2004.

Also, Caltrans did not adequately address the possibility that risks it could not identify through its risk management efforts would affect the ultimate cost of the project. Although such unknown risks cannot be managed, project managers may address them by creating a contingency reserve based on past experience with similar projects. According to the *PMBOK Guide*, quantitative risk analysis includes using historical information, expert judgment, and other sources of information, and assessing the probability of achieving project cost and time objectives, to calculate a contingency reserve amount needed for the project. For example, the December 2002 quality assurance review that the Central Region performed found that, based on its analysis of eight Bay Area seismic retrofit bridge projects, costs had increased by an average of 20 percent over estimates. As such, the Central Region recommended including contingency reserves of at least 20 percent for unknown risks and for unforeseen disputes or additional costs to close down the signature span project. However, from December 2002 through May 2004 Caltrans' internal estimates for the signature span contracts included only a 5 percent project contingency reserve.

A December 2002 quality assurance review recommended contingency reserves of at least 20 percent; however, Caltrans' internal estimates for the signature span contracts included only a 5 percent project contingency reserve.

Additionally, the February 2003 risk assessment indicated that Caltrans should consider applying a statistical risk simulation to the project. Caltrans did not attempt to do so. The Bechtel cost review released by the commission in August 2004 included a quantitative assessment of risks to individual project budgets and for the program. This review included a statistical simulation to quantify risks in terms of cost. This statistical

analysis indicated that a $900 million contingency would provide 80 percent assurance that Caltrans would stay within its revised budget: $660 million of the program contingency related to cost risks and $240 million to schedule risks.

The program's high cost and inherent risks demanded that Caltrans perform such an analysis on a regular basis, not just when it was obvious that it would greatly exceed its AB 1171 budget. Bechtel had performed a similar analysis of the program in 2001. Had Caltrans performed these types of quantitative risk analyses on an ongoing basis, it may have been able to determine earlier that it would not stay within the AB 1171 budget.

CALTRANS DOES NOT REGULARLY UPDATE PROGRAM COST ESTIMATES TO MONITOR THE PROGRAM'S BUDGET APPROPRIATELY

Key Elements of Project Cost Management We Reviewed, According to the *PMBOK Guide*

1. **Cost estimating**—developing an approximation (estimate) of the costs of the resources needed to complete project activities.
2. **Cost control**—controlling changes to the project budget.

We reviewed Caltrans' performance on two key elements of project cost management—cost estimating and cost control (see textbox). Cost estimating is important to project management because reasonably accurate and regularly updated information is critical to managing a project and reporting to stakeholders. According to the *PMBOK Guide*, project cost management includes the processes needed to ensure that a project is completed within the approved budget. Further, under FHWA major project program cost estimating guidance, estimates are central for establishing the basis for key project decisions, measuring project success, and communicating project status at any time. Under AB 1171, the Legislature gave Caltrans a budget of approximately $5.1 billion, including a $448 million program contingency reserve. However, Caltrans has not updated the projected program costs regularly to assess whether it is staying within the budget that AB 1171 established. In particular, Caltrans has not regularly updated its estimates of support costs needed for the life of the program and has not reassessed its program contingency reserve. Regularly updating internal cost estimates would allow Caltrans to prepare a detailed overview of the program that includes estimated capital and support costs for all bridges, and contingency reserve amounts. This overview, which would keep program managers aware of program-wide costs, should be updated regularly or as significant changes become known. Had Caltrans regularly

updated and monitored the program's cost, it would have recognized earlier that the program was exceeding its budget under AB 1171.

In addition to cost estimating, the *PMBOK Guide* emphasizes the importance of controlling changes to the project budget as part of effective cost management. We found that Caltrans follows its internal policies and procedures when issuing contract change orders that modify original contracts and increase project cost.

Caltrans Does Not Regularly Update Cost Estimates for the Whole Program

Although it prepares monthly estimates of costs on projects under construction, Caltrans lacks a regularly updated overview that includes actual costs, anticipated costs, and contingency reserves from a program-wide perspective. The *PMBOK Guide* notes that few projects run exactly according to plan, and that changes may require new or revised cost estimates or analyses of alternative approaches. Also, Caltrans' project management handbook notes that effective cost management requires project managers to regularly compare actual expenditures to planned expenditures at the level used in budget development. Further, FHWA strongly recommends development of a monthly cost, schedule, and status report, including a current cost forecast compared with the latest budget, with explanations for budget deviations.

Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide update of cost estimates since Caltrans prepared the cost estimates for AB 1171 in April 2001.

According to its director, Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide cost update since Caltrans prepared the cost estimates for AB 1171 in April 2001. After AB 1171, he says estimates were updated based on the specific milestone activities of individual contracts. Such milestone updates include the advertisement of a contract, a supplemental funds approval for a construction contract, or the completion of a construction contract. Caltrans has maintained the budget on a program basis and adjusted the individual contract budget, if required, based on information provided from a milestone for each contract. Caltrans manages the approved budget as set forth in the funding legislation and works to maintain this budget by mitigating potential risks that may affect the program budget. Nevertheless, the director says that a change in the law effective for 2004 requires Caltrans to begin reporting the program's status to the Legislature each quarter, therefore, Caltrans is implementing a process to update program-wide costs each quarter.

We recognize Caltrans has existing processes and procedures for managing project costs, including estimating and controlling costs, and prepares reports and cost estimates. On projects that are under construction, the construction division at Caltrans' headquarters prepares monthly toll bridge status reports that include the following status information: the project's original contractual cost, bid amount, total paid to the contractor, approved and pending contract changes that would increase the project's cost, potential additional costs from contractor claims for reimbursement, and the percentage a project is complete in dollars and time. According to the assistant construction coordinator for the office of toll bridges at Caltrans' construction division, the reports are an oversight tool to assist Caltrans' management in the early identification of critical issues; making construction management decisions; and assessing significant cost, scope, and schedule issues. Although useful, these reports provide perspective only on individual awarded contracts, rather than the program as a whole and do not provide a cost forecast. A program-wide overview would include regularly updated estimates of the resources needed to complete all projects in the program, whether or not they are under construction, and regular assessments of project and program contingency reserves. Further, managing to a budget and contract milestones is an inadequate solution when budget and timeline risks indicate the potential for large cost increases or time delays. Caltrans could use its status reports as a basis for a program-wide summary of costs and projected expenditures, integrating the information into a program-wide summary on a regular basis for use by Caltrans' management.

A program-wide overview would include regularly updated estimates of the resources needed to complete all projects in the program, whether or not they are under construction, and regular assessments of project and program contingency reserves.

Caltrans Did Not Regularly Reevaluate the Program's Support Costs

Proper tracking of support costs is important because they represent 17 percent of the program's budget (excluding the contingency reserve) that AB 1171 established in 2001. However, until recently, Caltrans did not regularly track whether its support costs, set at $796 million in AB 1171, were projected to stay within budget. Thus, during fiscal years 2002–03 and 2003–04, Caltrans lacked the information needed to identify cost increases that occurred before the estimate for total support costs jumped from $796 million under AB 1171 to $1.352 billion in August 2004. However, as of October 2003, Caltrans' accounting records showed that it had spent $612 million in support costs since the program began. In November 2003, Caltrans reported to FHWA that it was reducing its support

cost budget to $766 million, leaving only $154 million to pay support costs through 2011. If Caltrans had been updating its estimates of support costs regularly, it would have known at that time that its remaining budget of $154 million for support costs over the remaining eight years of the program was insufficient. At its 2003 usage rate of $8 million per month, Caltrans would have spent its remaining support cost budget of $154 million by June 2005.

Further, Caltrans provided us documentation of its August 2004 estimate of support costs for the program, showing that it expected $713 million of the $796 million budgeted to be consumed by June 30, 2004. According to the project control manager charged with overseeing support costs estimates, the project control unit for Caltrans' District 4 Office prepared a detailed estimate of total support costs needed for the remainder of the program in March 2004, but he was not aware of Caltrans completing such support costs estimates for fiscal years 2002–03 or 2003–04. He indicates developing the current total support costs estimates without the benefit of a post-AB 1171 estimate. This manager also indicates that Caltrans is updating the current methodology for estimating support costs and plans to use it again in fiscal year 2005–06.

It is difficult to understand how Caltrans did not know that it would overspend its support costs budget of $796 million in November 2003, given that by then, Caltrans, like all state departments, would have submitted its fiscal year 2004–05 Governor's Budget with its projected expenditures.

It is difficult to understand how Caltrans did not know that it would overspend its support cost budget of $796 million in November 2003, much less support its assertion that it would have savings of $30 million, which it also reported to FHWA in November 2003. In July to September 2003, Caltrans, like all state departments, would have submitted budget change proposals for the fiscal year 2004–05 Governor's Budget that documented proposals to change or maintain the existing level of services. In addition, Caltrans would have had details supporting fiscal year 2002–03 actual expenditures, fiscal year 2003–04 estimated actual expenditures, and fiscal year 2004–05 proposed expenditures. We did not review the details supporting Caltrans' pages of the fiscal year 2004–05 Governor's Budget. However, the estimated support costs reported by Caltrans to FHWA for the remainder of the program would have been exhausted around the end of fiscal year 2004–05 if the supporting schedules correctly reflected the rate of spending that did occur in fiscal year 2002–03, that was occurring in fiscal year 2003–04, and that was proposed for fiscal year 2004–05.

Caltrans Had Not Regularly Reevaluated the Program's Contingency Reserve Nor Accounted for Potential Cost Increases

Because Caltrans reevaluates the program's contingency reserve infrequently, its August 2004 report includes the first reevaluation of the program's contingency reserve since AB 1171 became law in October 2001. Yet, during this three-year gap, Caltrans had several signs that its program contingency reserve was insufficient to cover cost overruns. Without a regularly updated contingency reserve figure, program managers lack critical information to mitigate estimated or actual cost increases and the information to make a timely appeal for additional funding from the Legislature.

In November 2003, Caltrans reported to FHWA that it would use $326 million of its $448 million program contingency reserve to offset cost overruns, leaving only $122 million to be allocated to future cost overruns. However, Caltrans announced to the Legislature in its August 2004 report that the program contingency reserve should be increased to $900 million. In other words, as shown in Table 3 on page 19, after Caltrans allocates the entire AB 1171 contingency reserve of $448 million to cover a portion of the $2.768 billion in projected cost increases over AB 1171, it estimates it will need $2.32 billion of additional project funding plus a $900 million program contingency reserve, for a total need of $3.22 billion.

A joint effort by Caltrans, Bechtel, and the commission increased Caltrans' May 2004 cost estimate of $6.8 billion to $8.3 billion, including a $900 million contingency reserve.

In addition, the Caltrans' cost estimates initially drawn up for the August 2004 report significantly underestimated the program's cost. In June 2004, Caltrans asked the commission to request Bechtel to review Caltrans' May 2004 estimate of program costs, which were $6.8 billion, including a $223 million contingency reserve. After a joint effort by Caltrans, Bechtel, and the commission, Caltrans issued its August 2004 report projecting total program costs of $8.3 billion, including a $900 million contingency reserve. The joint review resulted in several adjustments. For example, according to supporting documentation for Bechtel's August 2004 cost review, Caltrans did not account for $452 million in potential future capital costs associated with adjustments to reflect increased prices for steel and concrete, contractor's time-related overhead and mobilization, and escalation costs for several projects. This includes escalation for certain projects where construction had not yet begun. Escalation for these projects is important because there may be increases in costs due to inflation, delays, and other factors that prudent contractors will take into account when preparing their bids or reimbursement requests. Also, the

joint review determined that a $900 million contingency reserve was more appropriate than the $223 million contingency reserve that Caltrans initially estimated.

Caltrans Generally Follows Its Internal Contract Change Order Policies

Caltrans generally follows its internal contract change order (change order) policies and procedures when paying contractors for work that is outside a construction contract. Caltrans issues change orders to make changes to original contracts, paying for changes with contingency reserves. Caltrans may prepare change orders to adjust contract plans or specifications, adjust the contractor's compensation, clarify contract terms, implement a cost reduction proposal, direct the contractor to do extra work, or resolve disputes or potential claims with a contractor. Caltrans' construction manual sets forth policies and procedures for preparing change orders, describing required approvals and concurrences, and procedures for different types of payment methods and performing cost estimates. We found that Caltrans complied with its internal policies and procedures when we reviewed a sample of 20 change orders with a value greater than $1 million for the Richmond-San Rafael Bridge and skyway projects and greater than $300,000 for the west approach project. In addition, Caltrans performed an appropriate assessment of each change order's impact on the overall project.

Caltrans complied with its internal policies and procedures in our sample of 20 change orders.

Project construction personnel determine if the proposed change is within the scope of the original contract, evaluate the effect of any time adjustment on project completion, and consider if contingency reserve balances are sufficient to pay for the change. Caltrans allows several different methods to determine how much it will pay on a change order. Caltrans' resident engineers may choose to pay the change order for contract items at contract prices or with adjustments to contract prices. For extra work, the resident engineers may negotiate an agreed unit price or a lump sum amount. They also may make a force account estimate, in which Caltrans agrees to reimburse the contractor by adding specified mark-ups to the actual costs of material, equipment, and labor. Caltrans policy considers the use of a force account payment, which does not lock the contractor to set prices, to be the least preferred method of determining payments for a change order. It requires resident engineers to make every effort to adjust contract prices, or negotiate an agreed price, which locks the contractor to that unit price or lump sum amount, before resorting to this method.

Caltrans used the force account payment method exclusively or primarily in 11 of the 20 change orders we reviewed. A supervising transportation engineer from the skyway project and the project manager over the Richmond-San Rafael Bridge and West Approach retrofits explained that the force account method was used to determine the extra work costs in nine of these 11 change orders because Caltrans could not estimate the work within reasonable limits of accuracy or because they could not negotiate an amount with the contractor. Two change orders paid for traffic control, which Caltrans pays for at actual cost. Nevertheless, Caltrans personnel are required to check extra work bills submitted by the contractor for appropriate rates and allowable items before approving force account payments, a process that should protect Caltrans from overpaying for change orders.

To assist in resolving disputes and potential claims on which Caltrans and a contractor cannot agree, Caltrans and the contractor may establish a dispute review board at the beginning of a project to review both parties' positions and provide recommendations to resolve disputes. The dispute review board—an individual representing Caltrans, the contractor, and a jointly selected member—initially makes recommendations on the merits of the dispute. If requested by either party, it recommends guidelines for determining compensation. Its recommendations are not binding, however, and either party may ask the board to reconsider its rulings if new evidence is submitted. All three projects we reviewed had set up dispute review boards, but none of the change orders we tested has dispute review board rulings. According to the East Span project manager, Caltrans uses the dispute review board as a last resort, when dispute or potential claim resolution is unsuccessful. Further, she indicates that Caltrans hopes to resolve most issues before the dispute review board's involvement, so Caltrans refers only the most contentious issues to the dispute review board.

CALTRANS DID NOT EMPLOY GOOD COMMUNICATIONS MANAGEMENT, RESULTING IN THE FAILURE TO REPORT COST OVERRUNS TO STAKEHOLDERS IN A TIMELY FASHION

Caltrans failed to keep its stakeholders informed of relevant changes in its estimates of program costs and cost overruns on a reasonable and timely basis. Although state law requires regular reporting to the Legislature, Caltrans did not provide a status report on the program for 2003 or the first half of 2004 until August 2004. There were multiple indicators that the program

would experience large cost overruns during 2003 and the first half of 2004, yet Caltrans failed to inform the Legislature through its statutorily required reporting. Caltrans had strong indications that the program's costs would exceed the AB 1171 cost estimates as early as November 2003, when it provided its annual financial plan to FHWA. However, its financial plan contained information that did not reflect its internal cost estimates, and thus understated the extent of the cost overruns. Moreover, Caltrans provided no information on potential program funding shortfalls before May 2004 to the commission, a critical stakeholder that represents the commuters who pay to use the toll bridges.

Elements of Project Communications Management According to the *PMBOK Guide*

1. **Communications planning**—determining the information and communications needs of stakeholders: who needs what information, when they will need it, and how it will be given to them.
2. **Information distribution**—making needed information available to project stakeholders in a timely manner.
3. **Performance reporting**—collecting and disseminating performance information. This includes status reporting, progress measurement, and forecasting.
4. **Administrative closure**—generating, gathering, and disseminating information to formalize a phase or project completion.

The *PMBOK Guide* defines project communications as the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. The major processes of communications management are listed in the textbox. Because state and federal law impose specific reporting requirements on Caltrans, we focused on the first three elements listed in the textbox and how well Caltrans kept its stakeholders informed of major changes in the costs for the program. We identified Caltrans' key stakeholders as the Legislature, FHWA, the commission, and BATA.

Caltrans Failed to Report the Program's Status and Cost Overruns to the Legislature, as State Law Requires

Although state law requires Caltrans to periodically report the program's status and notify the Legislature of program cost overruns, Caltrans did not report cost overruns it should have known of until they were staggering. After submitting no status report for 2003 or the first half of 2004, Caltrans reported to the Legislature in August 2004 that the program's costs would greatly exceed its funds. With the sole bid for the signature span's superstructure expiring on September 30, 2004, Caltrans gave the Legislature about six weeks to develop a funding solution to the $3.2 billion cost overrun. Had Caltrans kept it better appraised of the program's estimated costs, the Legislature could have better considered how to address and fund cost overruns as they occurred rather than having to suddenly address a $3.2 billion cost overrun. This earlier

notification could have come as early as November 2003, when, as discussed here, Caltrans had strong indications that the program's cost would exceed the AB 1171 cost estimates.

Under the Streets and Highway Code (code), Caltrans is required to provide program status reports to the Legislature. Through 2003, the code required annual reporting; beginning in 2004 the law was changed to require quarterly reports of the program's status. These quarterly reports are supposed to include the following items:

- The status, including details, of each toll bridge project.
- The baseline budget at the time of AB 1171.
- An updated budget and expenditures to date for support and capital outlay costs.
- A comparison between the baseline and the updated budget.
- A summary of milestones achieved, issues identified, and actions taken to address those issues.

In addition, the code requires that if Caltrans "determines that the actual costs exceed the [budget provided in AB 1171, Caltrans] shall report to the Legislature within 90 days from the date of that determination as to the difference and the reason for the increase in costs."

Caltrans submitted no status report for 2003 or the first half of 2004 until it reported in August 2004 that the program's costs could greatly exceed its funds.

However, Caltrans submitted no status report for 2003 or for the first quarter of 2004. As mentioned earlier, Caltrans did submit a report to the Legislature in August 2004 to meet the statutory requirement related to actual costs exceeding the program's budget provided in AB 1171, in which it reported that the program's "potential actual costs" would exceed the funding provided in AB 1171 by approximately $3.2 billion, including increasing the program's contingency reserve by $452 million.

According to its director, with the new quarterly report requirements established by Chapter 525, Statutes of 2003—Assembly Bill 1717 (AB 1717)—Caltrans elected to include the status information for 2003 in the first quarterly report for 2004. Caltrans intended to submit the first quarterly report for 2004 by May 2004 consistent with past practice. Previous annual reports had been submitted in April 2001, March 2002, and May 2003. The director further stated that it was assumed internally that the annual report requirement was replaced by the new quarterly report requirements in AB 1717

and that submitting the first quarterly report with appropriate status information would suffice to meet the requirements of the statutes. Caltrans made a conscious decision that given the imminent bid opening of the contract for the signature span's superstructure due on May 26, 2004, and the dynamics of the bidding environment and market prices for steel and concrete, submittal of a quarterly report in May 2004 would lack meaningful detail to report before confirmation of the detail of the bid. The director said that, after the bid opening, Caltrans' speculation was replaced with certainty that the bid would cause the program to exceed the AB 1171 program budget and that Caltrans was then obligated to report within 90 days to the Legislature that the program's actual costs would exceed the AB 1171 budget. The director added that after the bid opening and during the subsequent detailed program cost review during June and July 2004 with the commission and Bechtel, Caltrans was able to address the requirements of the 90-day report more meaningfully. According to the director, Caltrans' August 2004 report to the Legislature was intended to cover the time period since the previous annual report and the first two quarterly reports required by AB 1171.

Nevertheless, according to our legal counsel, Caltrans was still obligated to submit an annual report for 2003 despite the code's change to require quarterly reporting commencing with 2004. Moreover, the legislative intent was clearly to require more frequent reporting commencing with 2004 and not to relieve Caltrans of its obligation to provide an annual report for 2003. Further, our legal counsel indicates that Caltrans was required to begin reporting quarterly during 2004, with the first report covering January through March 2004. In addition, as shown in the next section, Caltrans should have known of large potential cost overruns as early as November 2003 that should have caused it to report that the program was over budget, for the same reason as it did later in August 2004.

Caltrans Should Have Known Significant Cost Overruns Were Likely When It Reported the Program's Status to the Federal Government in November 2003

Under federal law, entities receiving federal funds for a project with an estimated cost of $1 billion or more must submit a financial plan by November 15 of each year to FHWA. Caltrans' financial plan that it submitted to the FHWA in November 2003 showed that the program's projects were exceeding AB 1171 cost estimates and that there was less

Six months after Caltrans' February 2004 letter to FHWA asserted that the program contingency reserve of $122 million was sufficient, it reported to the Legislature that the program was over budget by $3.2 billion.

than a 3 percent program contingency reserve remaining to fund any further cost overruns for a program that was eight years from completion. Six months after Caltrans' February 2004 letter to FHWA asserted that the program contingency reserve of $122 million was sufficient, it reported to the Legislature that the program was over budget by $3.2 billion related to the signature span and other projected cost increases. Further, Caltrans certified to the FHWA that "The cost data in the Financial Plan provide an accurate accounting of costs incurred to date and include a realistic estimate of future costs based on engineers' estimates and expected construction cost escalation factors." If Caltrans had performed the work necessary to support statements in its certification to FHWA—such as computing the needed support costs or determining the necessary contingency reserve for the remainder of the program (which it later performed for the August 2004 report)—this report should have caused Caltrans to notify the Legislature of the potential for program cost overruns, for the same reason as it did later in August 2004.

According to its director, Caltrans disagrees that information in the FHWA report required Caltrans to notify the Legislature of cost overruns for the program. He indicates that Caltrans' report to FHWA said the signature span's superstructure was still in advertisement, the East Span schedule recently had been extended with the readvertisement of the contract for the signature span's marine foundation, which included provisions to add one year to the construction duration, and the financial implications of the Richmond-San Rafael Bridge construction contract had not been evaluated fully.

The director said the impact upon support costs had not been evaluated because the schedule extension of the East Span was a recent event. According to the director, because of the dynamic nature of these ongoing events, Caltrans had not concluded in November 2003 that cost increases in the program would exceed the AB 1171 budget and contingency limitations, and, as such, was not required to report to the Legislature.

However, as shown in Table 6 on page 64, Caltrans had ample information in November 2003 to determine that program costs would exceed its AB 1171 budget. In its November 2003 financial plan, Caltrans estimated total project costs at $4.963 billion, $326 million greater than the AB 1171 budget of $4.637 billion. Caltrans' financial plan caused FHWA to question several issues regarding the program's funding.

An FHWA financial manager indicated to us that as early as November 2003 she emphasized to Caltrans executives the importance of disclosing any knowledge of potential cost overruns related to the East Span to the federal government and other stakeholders.

Further, the FHWA financial manager assigned to review the financial plan indicated to us that as early as November 2003 she emphasized to Caltrans executives during project meetings and communications the importance of disclosing any knowledge of potential cost overruns related to the East Span to the federal government and other stakeholders. In January 2004, FHWA sent a letter to Caltrans with its concerns. In February 2004, to address FHWA's comments and questions, Caltrans supplied a breakdown of program costs, indicating the program had total cost overruns of $563 million. Caltrans told FHWA it would use $237 million in projected savings and $326 million from the program contingency reserve to pay for these cost overruns. However, these savings had almost evaporated by the time Caltrans reassessed the program's viability for its August 2004 report. For example, Caltrans indicated that it could reduce support costs by $30 million by using fewer consultants to supplement Caltrans employees assigned to oversee the program. However, in August 2004—six months after it reported this $30 million in support cost savings to FHWA—Caltrans indicated that it needed additional funding of $556 million to fund future support costs. Further, Caltrans indicated it could achieve savings on the current East Span by reducing estimated costs by $44 million for the demolition of the East Span and $56 million for the Oakland touchdown. However, in August 2004, Caltrans increased estimated costs for these projects over the figures it reported to FHWA in February: $145 million for the East Span demolition and $147 million for the Oakland touchdown. Caltrans did not report any of these figures to the Legislature until the August 2004 report as part of an even larger cost overrun. This oversight is especially troubling because Caltrans had committed 73 percent of its program contingency reserve to projects under construction and not yet received a bid for the signature span's superstructure, which proved to be the most expensive piece of the entire program. Further, Caltrans could not provide us with documentation of the methodology and calculations behind the cost savings it reported to FHWA.

In its January 2004 letter, FHWA also expressed concern that the program had virtually no contingency reserve. The chief deputy district director for the toll bridge program indicated that Caltrans and FHWA met several times to discuss FHWA's concerns. In its February 2004 response, Caltrans answered each of FHWA's questions and provided additional cost detail. Caltrans' response clarified that the program overall had a program contingency reserve of $448 million and that $326 million of that amount would be used to offset program

cost overruns, leaving a remaining balance of $122 million to fund any future cost overruns. FHWA also asked what alternatives would be available to address a funding shortfall. Caltrans responded that its existing authority under AB 1171 allowed it to issue GARVEE bonds or notes, which are tax-exempt financial instruments repaid by future annual federal appropriations for federal aid transportation projects. Although these notes quicken the receipt of cash, they are not a supplemental funding source. Caltrans also indicated several funding alternatives existed requiring legislative approval, including raising the toll on the bridges by $1 to generate an additional $120 million annually that could leverage more than $1 billion in additional debt, removing the cap on existing bonds to provide additional bonding capacity, or extending the terms on the existing bonds beyond 2038. FHWA subsequently accepted Caltrans' response later in February 2004.

Caltrans' response failed to inform FHWA of the likely extent of estimated program costs because the amount Caltrans already had spent at the time of its report was close to or higher than some estimates, yet the program was years from completion. Title 23, U.S. Code, Section 106, requires that the annual financial plan for projects with estimated costs of at least $1 billion be based on detailed annual estimates of the cost to complete the remaining elements of the project and on reasonable assumptions of future increases in the cost to complete the project. However, based on internal Caltrans reports and the amounts that it eventually reported to the Legislature in August 2004, Caltrans should have known that the program was experiencing cost overruns. Table 6 on the following page shows the progression of cost estimates for the program from the original estimates in AB 1171 to the estimates in Caltrans' August 2004 report.

In its November 2003 report to the federal government, Caltrans claimed it would achieve $130 million in cost savings in three program areas, yet by August 2004, Caltrans reported that it would need additional funds totaling $748 million more than the AB 1171 estimate for the same three program areas.

In its report to FHWA, Caltrans claimed that it would save $130 million in three program areas—$30 million in support costs, $56 million in Oakland touchdown costs, and $44 million in East Span demolition costs. Because of these purported savings, Caltrans was able to claim that it had a remaining contingency reserve of $122 million. However, by August 2004, it had reported for these same three areas (unrelated to the capital costs of the signature span bid) not only that it would not save $130 million from AB 1171 estimates but that it would need $748 million more than AB 1171 estimates. Thus, in six months it determined that the information it reported to FHWA was incorrect by $878 million for these three areas of purported savings.

TABLE 6

Progression of Cost Estimates for Key Items in the Toll Bridge Seismic Retrofit Program

Cost Item	AB 1171 Estimate (April 2001)	FHWA Report (November 2003, Updated in February 2004)*	Caltrans Internal Records at or Near November 2003	Caltrans' August 2004 Report to the Legislature
Caltrans support costs	$796	$ 766	$612 (spent through October 2003)	$1,352
Signature span projects				
Superstructure	589	†	1,137‡§	1,682
Foundations	128	†	‖	237
Yerba Buena Island	259	†	‖	368
Total signature span and Yerba Buena Island projects	**976**	**1,214**		**2,287**
Program contingency reserve	448	122	#	900
Richmond-San Rafael	570	570	613 to 648	780
Skyway	796	1,107	1,098 to 1,117	1,293
Oakland touchdown	171**	115	‖	262
Demolition	124**	80	‖	225

Sources: As noted in the table and in the footnotes.

* Caltrans could not provide us the supporting detail for the estimate at completion or cost savings amounts in its report and responses to FHWA.

† Caltrans provided only the total capital costs for the signature span contracts in its February 2004 response to FHWA. The director indicates that this was done to maintain the comparison of the original FHWA submittal documents to subsequent annual financial plan updates to FHWA.

‡ Caltrans indicates that it estimated the contract at $812 million in October 2003, which was its update to the engineer of record's estimate. The $812 million includes supplemental work, state furnished items, and contingencies totaling $86 million.

§ This estimate is from Caltrans' bridge cost estimating specialist and according to the director is speculative.

‖ We requested this information, but Caltrans did not provide it.

According to the director, Caltrans maintains a running contingency balance per awarded contract. Caltrans did not, however, keep a running balance of commitments against the program contingency reserve.

** In its response to FHWA, Caltrans showed amounts that were $1 million to $2 million different.

As shown in Table 6, significant differences exist between the amounts Caltrans reported to FHWA and the amounts contained in Caltrans' internal reports at or near November 2003, when Caltrans prepared the FHWA report. We discuss the reasons for these differences in the following sections. It is important to note that with Caltrans reporting a remaining balance in its contingency reserve of only $122 million and without having received a bid for the superstructure, nearly any one of the following differences was significant enough to cause Caltrans to report to the Legislature that funding for the program was insufficient to meet future needs.

Caltrans' Estimate for Support Costs for the Remaining Eight Years of the Program Was Understated Significantly

In its November 2003 report to FHWA, Caltrans significantly understated an estimate of the support costs it would incur over the program's remaining eight years. As shown in Table 6, Caltrans indicated to FHWA that its program support costs would total $766 million, a $30 million reduction from the AB 1171 amount. In response to FHWA's questions, Caltrans said it could produce savings of $30 million in support costs to offset increases in other program costs. However, as of October 2003, Caltrans' accounting records showed that it had spent $612 million in support costs since the program began, leaving only $154 million to pay support costs through 2011. At this point, Caltrans should have known that its support costs over the remaining eight years of the program would be much higher than $154 million and that it should revise its estimate upward, not downward. By November 2003, Caltrans reported to FHWA that it had extended the completion date of the project by four years beyond the year 2007 for which AB 1171 provided funding for support costs. By October 2003, Caltrans already had spent $612 million, thus the $154 million left in its estimate would have lasted little more than one-and-a-half years at its usage rate of $8 million per month for the 12-month period ending in October 2003. No resources would then be available for the remaining six-and-a-half year period of June 2005 through December 2011. For purposes of illustration, had Caltrans assumed a usage rate for this unfunded period at this usage rate of $8 million per month, it would have computed it needed an additional $624 million for a program total of roughly $1.4 billion.

By October 2003, Caltrans had already spent $612 million for support costs, thus the $154 million left in its estimate would have lasted little more than one-and-a-half years at its 2003 usage rate of $8 million per month. Therefore, no resources would then be available for the remaining six-and-a-half year period of June 2005 through December 2011.

When it finally performed an analysis of future support costs for its August 2004 report, rather than reduce the AB 1171 estimate by $30 million, it increased the estimate by $556 million, indicating that it would need $586 million more than it reported to FHWA. The revised support cost estimate of $1.352 billion indicates an average monthly support cost estimate of $7.6 million per month for the 98-month period November 2003 through December 2011.

Caltrans' Internal Estimates for the Signature Span's Superstructure Showed the Potential for Increased Costs Well Before the May 2004 Bid Was Received

Caltrans' internal estimates for the cost of the signature span's superstructure also were increasing and should have led Caltrans to alert the Legislature that program costs would

be higher than the AB 1171 estimates. When it advertised the superstructure for bid in February 2003, Caltrans indicated to bidders that the contract's "call-out number" (used to give bidders a general idea of the contract's scope) was $733 million. This amount was about $264 million more than the amount that Caltrans budgeted for the superstructure at the time of AB 1171. However, internal analyses show that Caltrans had indications that this figure was understated significantly. As shown in Table 7, these internal analyses show that, based on a consultant's mock bid, there were indications as early as August 2002 that the superstructure bid could be as high as $934 million. Also, in December 2003, the assigned Caltrans bridge cost estimating specialist computed an estimated cost of $1.036 billion. Further, shortly before the May 2004 bid opening, an internal estimate of the bid amount was nearly $1.3 billion, which was slightly less than the actual bid amount.

Although discounted by Caltrans, estimates of its bridge cost estimating specialist and a consultant proved more accurate than its official estimate of the bid for the superstructure of the signature span.

The director provided the following clarifying remarks about the estimates in Table 7. He stated that the mock bid estimate was prepared by a different consultant in an abbreviated timeline and lacked a detailed analysis. Therefore, Caltrans determined that this estimate did not justify a revision. Subsequently, Caltrans did revise the engineer of record's estimate in May, June, and October 2003 to reflect the changes made by addenda to plans and specifications. However, he stated that the December 2003 cost scenario was a limited analysis to ascertain if the addenda at that time had ameliorated the cost issues created by the changing construction market. This cost scenario was developed in part based on the recent single bid received for the marine foundation of the signature span. Further contract changes were made before bid opening. Accordingly, Caltrans determined that this cost scenario did not justify a revision to its October 2003 mathematical update to individual contract line items.

The director further said that during the last few months of the advertisement period for the superstructure contract (March and April 2004), contractors and subcontractors were indicating that increasing market prices would affect their bid amount. This information was limited in nature and consisted of calls to contacts in the fabrication and steel industries, so its accuracy was viewed as unreliable. The director said Caltrans was unable to confirm this information until an actual bid was received. Due to the anticipated competition between bidders, Caltrans was uncertain what the bidding environment might yield at bid opening. As a result, the director indicates that Caltrans

TABLE 7

Timeline of Estimates for the Signature Span's Superstructure

Basis for Estimate	Date	Amount
AB 1171 estimate	April 2001	$469 million
Consultant's mock bid*	August 2002	$934 million
Engineer of record's estimate†	December 2002	$637 million
Caltrans' call-out number‡	February 2003	$733 million
Caltrans' mathematical update to the engineer of record's estimate§	June 2003	$703 million
Caltrans' mathematical update to the engineer of record's estimate§	October 2003	$726 million
Caltrans bridge cost estimating specialist‖	December 2003	$1.036 billion
Caltrans bridge cost estimating specialist‖	April 2004	$1.286 billion
Bid received by sole bidder#	May 2004	$1.399 billion (foreign steel) $1.804 billion (domestic steel)

Note: Estimates exclude supplemental work, state furnished items, and project contingency.

* Estimate was produced by Caltrans' value analysis consultant.

† Estimate represents the Caltrans consultant engineer of record's estimate.

‡ Estimate was based on final bid items for the advertised contract.

§ Estimate was based on Caltrans' mathematical update to individual contract line items based on addenda to plans and specifications. These addenda add payment provisions, correct errors, and add or eliminate bid items.

‖ The Caltrans director says the estimates of Caltrans' bridge cost estimating specialist were speculative and do not reflect the engineer of record's estimate at the time.

The single bid included domestic steel and foreign steel bids.

did not update its October 2003 estimate due to the continued improvements to the contract that it made through the addendum process during the advertisement period. Caltrans based these changes on prospective bidders' feedback on issues such as contract time, cash flow, bonding, and constructibility. The actual impact that the spike in steel prices would have on the contract remained uncertain, as the contractor would not actually purchase the plate steel until at least one year from the contract award date. Finally, the director stated that the final contract contained significant improvements from the original contract from which the engineer of record produced an estimate.

However, by continuing to use cost estimates that were being called into question by other factors, Caltrans gave the impression that the sole bid for the superstructure was far above its expectations. The value analysis by another consultant and the even higher estimates of its bridge cost estimating specialist were discounted by Caltrans in favor of its official estimate.

Yet their increasingly higher estimates of the superstructure's cost—in the range of $1 billion or more—proved to be more accurate. Caltrans also states that the higher estimates could not be used because of limited or incomplete analysis, or because they were overtaken by events in the marketplace. However, given an environment of changing materials prices, contractor feedback, and other strong indications of a high bid, Caltrans should have devoted the time and staff to produce a detailed up-to-date cost estimate rather than rely on its older estimate.

The Program Contingency Reserve Was Almost Completely Committed in November 2003

The program contingency reserve that Caltrans reported to FHWA was $122 million of the original $448 million budgeted in AB 1171. This balance seems grossly insufficient for several reasons, a primary one being that the bid for the signature span's superstructure was not yet received and Caltrans' internal estimates indicated that the superstructure would cost significantly more than expected. Further, the skyway section of the East Span was only 31 percent constructed, and likely to see significant cost escalation during construction, as Caltrans had found on other bridge projects. Less than a year later, in its August 2004 report, Caltrans concluded that the program needed a much larger contingency reserve, suggesting that it be replenished to $448 million and increased by an additional $452 million, to raise the total contingency reserve to $900 million. Given the $122 million figure in the FHWA report, Caltrans should have reported to the Legislature in 2003 that the program had a serious shortage of contingency reserves.

The Estimated Cost for the Richmond-San Rafael Bridge Was Higher Than Caltrans Reported to FHWA

In response to FHWA's questions, Caltrans asserted that the cost for the Richmond-San Rafael Bridge would be $570 million, but internal reports showed a total potential cost of $613 million to $648 million.

Caltrans underreported to FHWA the estimated costs for the retrofit work to the Richmond-San Rafael Bridge. In response to FHWA's questions, Caltrans asserted that the estimated capital outlay cost for the Richmond-San Rafael Bridge as of November 2003 would be $570 million, including any remaining contingency reserve balance. However, internal reports show that the total potential cost as of October 2003 ranged from $613 million to $648 million, including the probable amounts Caltrans would need to pay on the contractor's pending reimbursement claims. As a result, in October 2003 Caltrans expected it would need to find $43 million to $78 million to cover the cost of this bridge

before considering the need for additional contingency reserves for possible future claims. Although there were sufficient funds remaining in the program contingency reserve to cover these costs—$122 million as noted previously—funding them would be a significant drain and reduce the amount of contingency reserve available to other projects in the program. Moreover, in its August 2004 report, Caltrans reported that the Richmond-San Rafael Bridge would incur additional cost overruns, which would raise the total estimated capital outlay cost for the project to $780 million.

The Skyway Was Less Than Half Constructed and Was Likely to Require Additional Funding to Cover Unforeseen Cost Increases

Caltrans had sufficient indications that the skyway's costs would continue to increase because it was relatively early in the project's construction. As of November 2003, the skyway was only 31 percent constructed, yet its projected cost was $302 million to $321 million over the AB 1171 estimate, and Caltrans reported having only a $20 million contingency reserve balance for the project. Given that significant work remained on the skyway, Caltrans should have known that costs would increase, causing a further drain on the program's contingency reserve. In fact, Caltrans stated in its August 2004 report that the skyway's estimated cost had increased $186 million beyond the amount it reported to FHWA, with the total estimated capital cost for the skyway rising to $1.293 billion.

Caltrans Did Not Keep the Commission Informed of the Program's Cost Overruns

Caltrans has not updated the commission regularly on the program's cost overruns for ongoing projects and on changing cost estimates for the signature span. Such omissions are especially unwise because the toll bridges are an essential part of the commission's regional transportation plan and the San Francisco Bay Area's toll payers, whose payments are administered by BATA and the State, are the program's largest funding source. Also, according to Caltrans' February 2004 response to FHWA, toll increases are the largest funding option to pay for future cost overruns. By keeping the commission relatively uninformed about the large cost overruns within the program, Caltrans risks losing the support of the stakeholder that it informed FHWA was most likely to bail out the program by raising new revenues.

Caltrans risks losing the support of the stakeholder that it informed FHWA was most likely to bail out the program by raising new revenues.

According to the commission's manager of bridge and highway operations, the only updates that Caltrans provided the commission were the statutorily required reports that Caltrans prepares for the Legislature. However, as noted previously, Caltrans did not prepare a report for 2003, and its only report in 2004 was the August 2004 report. Further, the manager stated that the first time Caltrans officially disclosed to the commission that cost estimates for the seismic program would exceed the AB 1171 estimates was a meeting between Caltrans and the commission on June 2, 2004, or seven days after Caltrans opened the bid for the signature span's superstructure. At that meeting, Caltrans disclosed that it was estimating a total cost of the program at $6.8 billion, $1.7 billion more than in AB 1171. Also at that meeting, Caltrans requested that the commission assist Caltrans in the overall review of the program. The commission then hired a consultant, Bechtel, to review the reasonableness of the Caltrans cost forecast for the program. Subsequently, Bechtel issued a report in August 2004 that supported Caltrans' revised cost forecast of $8.3 billion for the program.

By contrast, Bechtel keeps the commission updated on the progress Caltrans makes on toll bridge work done as part of the Regional Measure 1 (measure 1) program. Bay Area voters approved measure 1 in November 1998 to authorize a toll of $1 for all seven state-owned toll bridges. The toll revenues that measure 1 generates are for certain highway and bridge improvements, public transit rail extensions, and other projects designed to reduce congestion on the toll bridges. Caltrans manages these projects for the commission, with the largest project being the new Benicia-Martinez Bridge, which will cost more than $1 billion. The commission contracts with Bechtel to monitor the measure 1 projects. Bechtel provides the commission a monthly progress report within 23 working days after each month. Focusing on monitoring project cost and schedule performance as measured against approved budget and schedule milestones, these monthly reports provide a mechanism to alert the commission promptly to potential cost and schedule problems.

Bechtel's monthly reports on construction projects in the measure 1 program alert the commission to potential cost and schedule problems.

According to the commission's bridge and highway operations manager, the commission sees a critical need for new oversight and management processes for the Toll Bridge Seismic Retrofit Program. In addition to implementing an ongoing monthly reporting system for the program, an improved management and oversight process should go beyond reporting to include processes to accomplish the following goals: anticipate and

identify construction issues early, allow issues to be reported to management and resolved as early as possible, evaluate and review construction change orders, and update and report cost and schedule estimates on a continuous basis.

RECOMMENDATIONS

To ensure that it properly manages the risks associated with these construction projects, Caltrans should continue to revise its risk management practices, but ensure that its efforts include:

- Establishing comprehensive risk management plans that clearly define roles and responsibilities for risk management and addresses how Caltrans will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the life of the project.

- Quantifying the effect of identified risks in financial terms.

- Developing and maintaining documents to track identified risks and related mitigation steps.

To ensure that it follows generally accepted practices for cost management, Caltrans should:

- Regularly update its estimates of capital and support costs.

- Regularly reassess its contingency reserves for potential claims and unknown risks, incorporating information related to risks identified and quantified through its risk assessment processes.

- Regularly integrate estimates for capital, support costs, and contingency reserves into a program-wide report.

To ensure that it follows generally accepted management practices for communications management, Caltrans should:

- Submit quarterly status reports to the Legislature, as the law requires.

- Ensure that reports to FHWA and other stakeholders reflect current data and provide an accurate representation of the program's status.

- When key events occur, such as a bid opening for a major project, quickly inform stakeholders how these events affect the program's overall budget and schedule.

The Legislature should consider revising state law to require that Caltrans submit its quarterly reports within a certain period after each quarter, such as 45 days, to ensure that the information Caltrans provides is current.

Although the code specifies certain elements to include in the quarterly seismic reports for the program, the Legislature should consider changing state law to require that these reports provide a program-wide summary of the program's budget status for both capital outlay and support costs. Specifically, the report should contain the following project and program-wide fiscal information:

- The baseline budget as provided for in state statute.

- Actual expenditures incurred to the end of the quarter.

- The current forecast of expenditures expected for the remainder of the program.

- Amounts of pending change orders, notice of pending claims, and other contractor claims outstanding at the end of the quarter and those that Caltrans has received within 10 days of submitting its quarterly report.

- A comparison of the baseline budget provided in statute compared with expenditures incurred to the end of the quarter; the current forecast of expenditures for the remainder of the program; and outstanding change orders, notice of pending claims, or other contractor claims.

- Commitments against both project and the program level contingency reserves, along with a realistic assessment of the adequacy of project and program contingency reserves.

- Contracts for projects that Caltrans has not yet entered into and the current estimates of the contract values by its engineer of record and bridge cost estimating specialist.

- A detailed description along with specific financial estimates of any other events or issues that could have a financial impact on the program.

- Certifications by the Caltrans director and deputy director of finance that the information in the quarterly report is an accurate and complete status and forecast of the program's financial condition.

- Certification by an independent engineering consultant that the information in the quarterly is an accurate and complete status and forecast of the program's financial condition.

In reviewing the options that Caltrans presents for completing the East Span, the Legislature should consider requesting that Caltrans provide sufficient detail to understand the financial implications of each option. Specifically, this detail should include for each option a breakdown of the costs for capital outlay, support, and contingencies at the project and program level. Further, to place each option in perspective, Caltrans should provide a reconciliation of each option to the figures it presented in its August 2004 report to the Legislature.

We conducted this review under the authority vested in the California State Auditor by Section 8543 et seq. of the California Government Code and according to generally accepted government auditing standards. We limited our review to those areas specified in the audit scope section of this report.

Respectfully submitted,

Elaine M. Howle

ELAINE M. HOWLE
State Auditor

Date: December 22, 2004

Staff: John Baier, CPA, Audit Principal
James Sandberg-Larsen, CPA
Mandi Gallardo
Fae Li
Kenneth Louie
Matthew G. See
Loretta T. Wright

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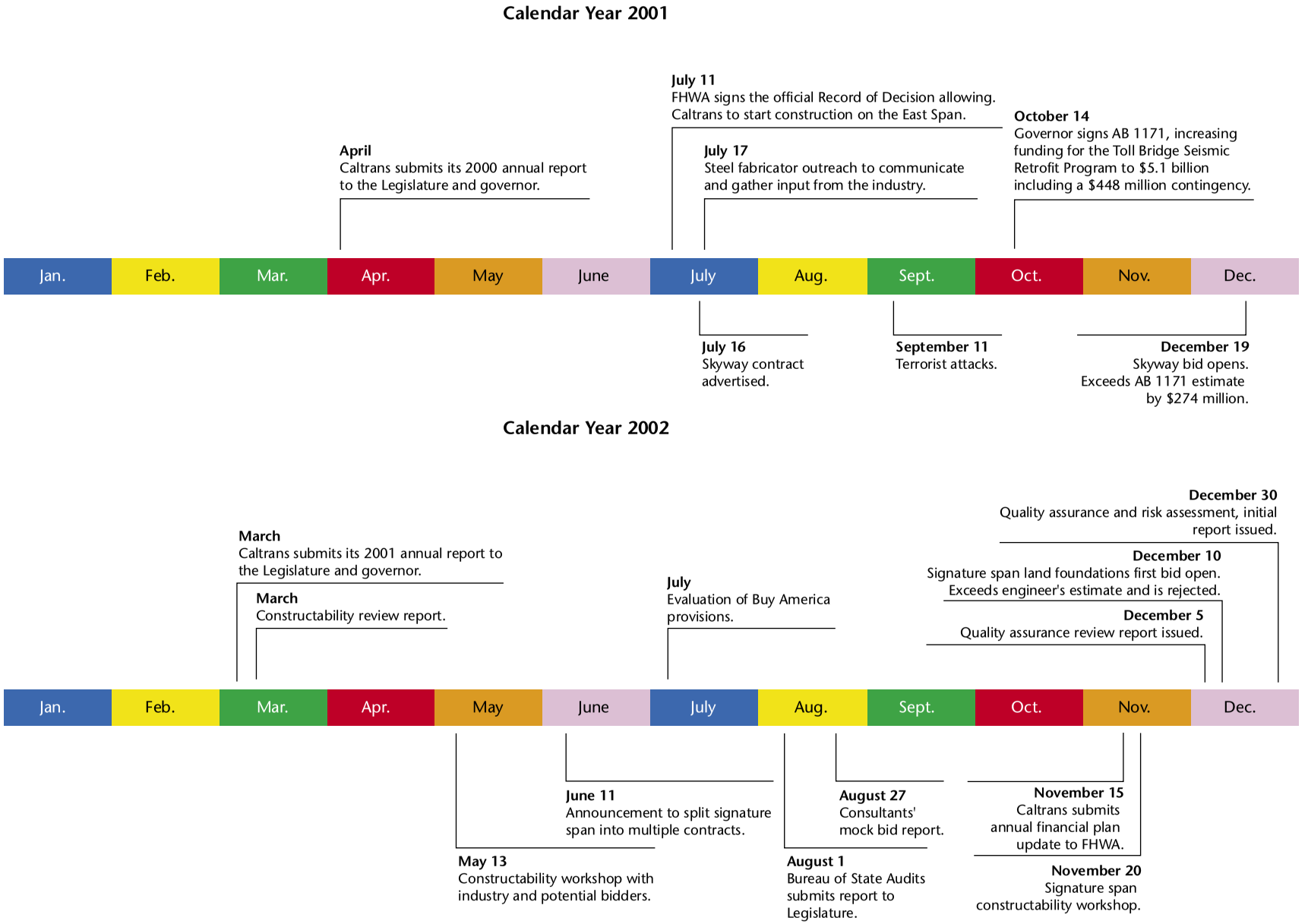
APPENDIX A

Timeline of Events Affecting the Toll Bridge Seismic Retrofit Program



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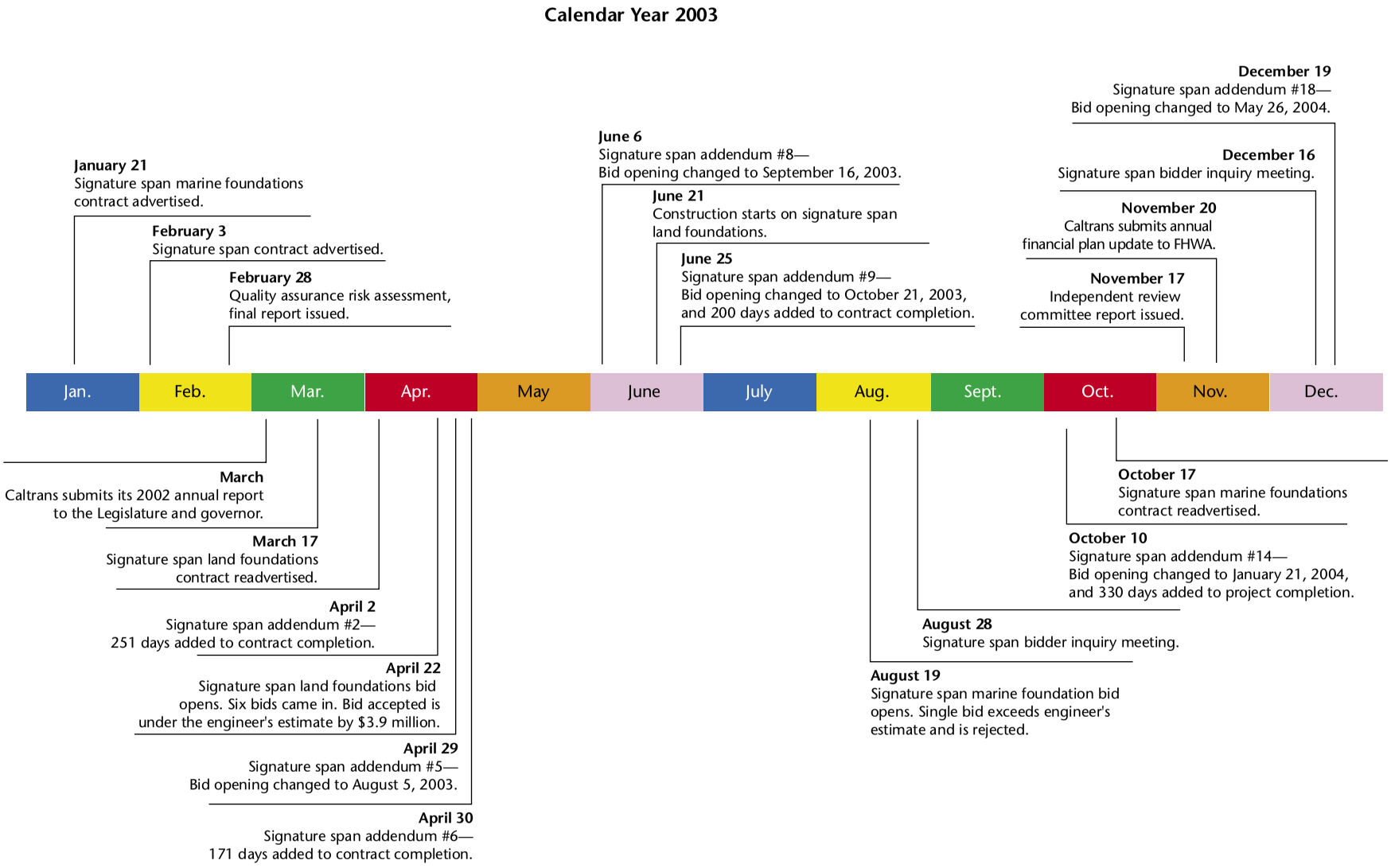
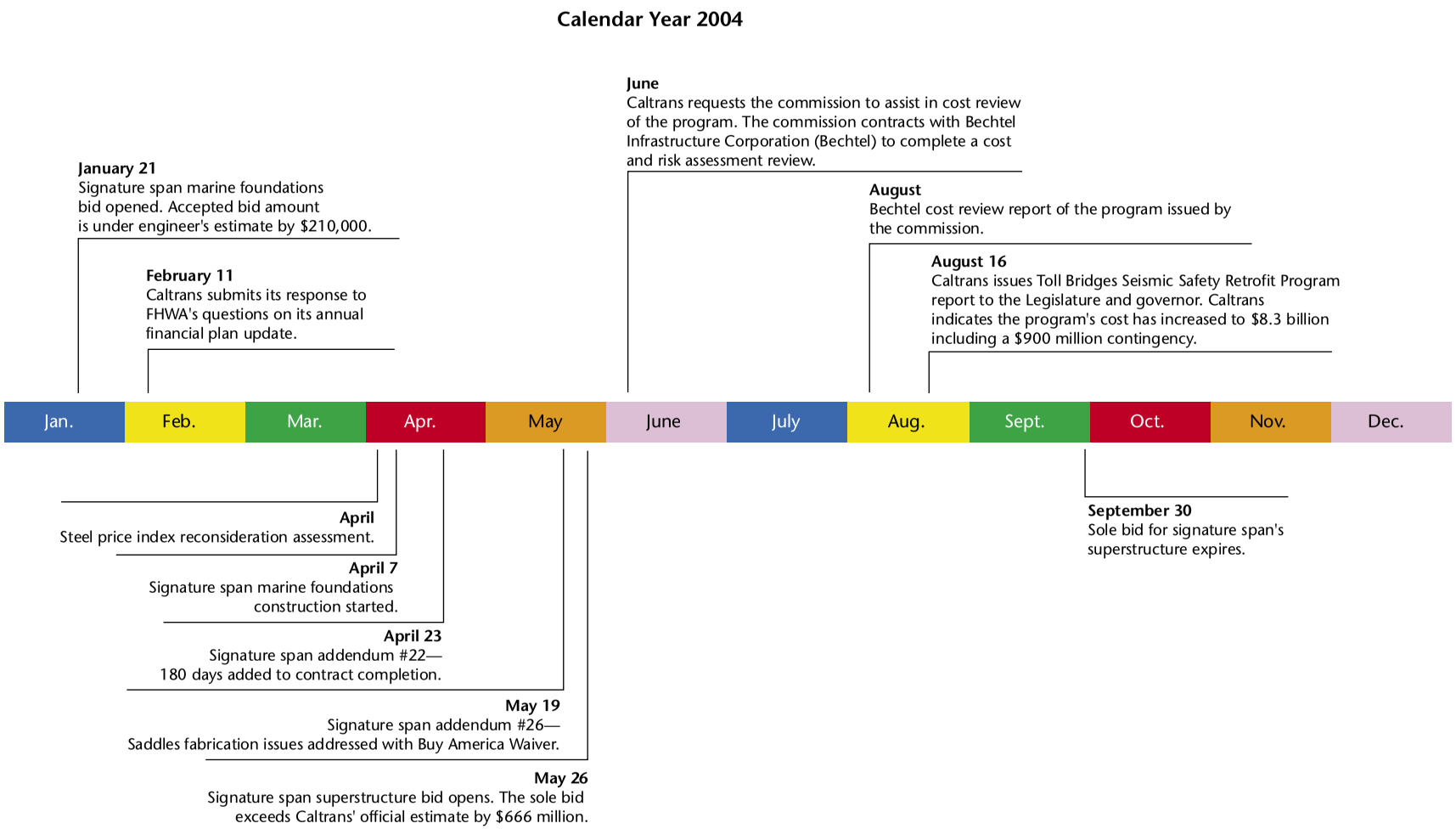

Calendar Year 2003
January 21
Signature span marine foundations contract advertised.
February 3
Signature span contract advertised.
February 28
Quality assurance risk assessment, final report issued.
March
Caltrans submits its 2002 annual report to the Legislature and governor.
March 17
Signature span land foundations contract readvertised.
April 2
Signature span addendum #2—251 days added to contract completion.
April 22
Signature span land foundations bid opens. Six bids came in. Bid accepted is under the engineer's estimate by $3.9 million.
April 29
Signature span addendum #5—Bid opening changed to August 5, 2003.
April 30
Signature span addendum #6—171 days added to contract completion.
June 6
Signature span addendum #8—Bid opening changed to September 16, 2003.
June 21
Construction starts on signature span land foundations.
June 25
Signature span addendum #9—Bid opening changed to October 21, 2003, and 200 days added to contract completion.
August 19
Signature span marine foundation bid opens. Single bid exceeds engineer's estimate and is rejected.
August 28
Signature span bidder inquiry meeting.
October 10
Signature span addendum #14—Bid opening changed to January 21, 2004, and 330 days added to project completion.
October 17
Signature span marine foundations contract readvertised.
November 17
Independent review committee report issued.
November 20
Caltrans submits annual financial plan update to FHWA.
December 16
Signature span bidder inquiry meeting.
December 19
Signature span addendum #18—Bid opening changed to May 26, 2004.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.


Calendar Year 2004
January 21
Signature span marine foundations bid opened. Accepted bid amount is under engineer's estimate by $210,000.
February 11
Caltrans submits its response to FHWA's questions on its annual financial plan update.
June
Caltrans requests the commission to assist in cost review of the program. The commission contracts with Bechtel Infrastructure Corporation (Bechtel) to complete a cost and risk assessment review.
August
Bechtel cost review report of the program issued by the commission.
August 16
Caltrans issues Toll Bridges Seismic Safety Retrofit Program report to the Legislature and governor. Caltrans indicates the program's cost has increased to $8.3 billion including a $900 million contingency.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
April
Steel price index reconsideration assessment.
April 7
Signature span marine foundations construction started.
April 23
Signature span addendum #22—180 days added to contract completion.
May 19
Signature span addendum #26—Saddles fabrication issues addressed with Buy America Waiver.
May 26
Signature span superstructure bid opens. The sole bid exceeds Caltrans' official estimate by $666 million.
September 30
Sole bid for signature span's superstructure expires.

Source: Caltrans' Toll Bridge Seismic Retrofit Program Cost/Schedule Mitigation timeline.

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Agency's comments provided as text only.

Business, Transportation and Housing Agency
980 9th Street, Suite 2450
Sacramento, CA 95814-2719

December 10, 2004

Elaine M. Howle*
State Auditor
Bureau of State Audits
555 Capitol Mall, Suite 300
Sacramento, CA 95814

Dear Ms. Howle:

Thank you for the opportunity to respond to your draft audit report, *Department of Transportation: Various Factors Increased Its Cost Estimates for Toll Bridge Retrofits and Its Program Management Needs Improving* (#2004-140). The Department of Transportation (Caltrans) response is attached.

As you know, Governor Schwarzenegger has committed to, and has already begun implementing changes to, streamline operations and improve efficiency and effectiveness in State government. I am pleased to see that your recommendations will assist us in achieving those goals. Moreover, I am gratified that you have concluded that no funds appropriated for the Toll Bridge Seismic Retrofit Program (TBSRP) were diverted for other uses, particularly given that this program has existed for several years.

As you note in your report, the challenge of building large and complex bridges in locations that have high seismic risk is very difficult and multi-faceted. Replacement of the East Span, in particular, has been and continues to be one of the most complex engineering projects ever undertaken and, as indicated in your report, has been adversely affected by factors both within and beyond the control of Caltrans. The self-anchored suspension (SAS) component, or signature span, which is the only one of its kind in the world, was a significant factor in the escalation of the costs of the project. Recently, in fact, the Business, Transportation and Housing (BTH) Agency convened an expert peer review team led by the Federal Highway Administration and composed of notable engineering expert practitioners and academicians from other states to provide advice on the decision whether to continue with plans to construct the signature span as part of the East Span. This objective team of experts concluded that the SAS component was so complicated and unique that there would continue to be significant risk of additional time delays and escalation of costs.

The BTH Agency is wholly committed to improving oversight and management in the TBSRP in general, and in the San Francisco-Oakland Bay Bridge (East Span) project, in particular. We recognize that Caltrans has performed admirably in certain aspects of the TBSRP, such as retrofitting five of the seven bridges under budget by a total of $48 million. We note, however, that the larger, more complex projects

* California State Auditor's comments begin on page 89.

require a different skill set, including greater emphasis on all project management components, such as risk management. Therefore, we have already taken several definitive actions to assess particular circumstances involving the East Span project, and to determine the best course of future action.

For example, once the scope of the issues regarding the funding for the East Span project was discovered earlier this year, the BTH Agency assembled a work group to determine whether the $878 million projected need for Capital Outlay Support (COS) was a reasonable estimate derived through a credible process. The workgroup, incidentally, concluded that a credible process was used to develop and validate the estimate, and that, by extension, the estimate was the best that could be expected at the point in time it was developed. Further, recognizing the effect of COS on the overall cost of the project, the BTH Agency has already formulated the scope of work for which it will be engaging the services of an expert consultant to assess the process Caltrans uses to estimate COS, and to provide recommendations for controlling COS on major construction projects.

Additionally, in line with your concerns regarding communications management, the BTH Agency independently assessed the circumstances surrounding the submission of statutorily mandated reports by Caltrans. We determined that, although Caltrans did not adhere to the requisite schedule, sufficient evidence exists to support the conclusion that Caltrans did not attempt to purposefully withhold TBSRP expenditure information from the Legislature. For example, reports containing said information were regularly provided to the California Transportation Commission (CTC), two ex-officio members of which are the chairs of the legislative transportation committees. Further, the information was presented at CTC meetings for which advance agendas noting the presentations were provided to key legislative committee staff and staff of the Legislative Analyst's Office, many of whom regularly attended the meetings. Although there is no justification for the failure to provide timely reports to the Legislature, the above factors should mitigate any concern that Caltrans failed to disclose the information altogether.

Finally, the BTH Agency has already contracted with a private consulting firm to conduct a supplementary review of the project management process used in the East Span project. The results of the consultant's work will be submitted to an independent expert panel for review and comment prior to being issued to the BTH Agency and Caltrans for use in improving the current process of project management.

I appreciate your recommendations for improving the manner in which Caltrans goes forward with the TBSRP. The changes Caltrans intends to make are detailed in its response. Again, thank you for the opportunity to respond to your draft audit report. If you need additional information, please do not hesitate to contact me, or Michael Tritz, Chief of the BTH Agency Office of Internal Audits, at (916) 324-7517.

Sincerely,

(Signed by: Michael R. Tritz for)

SUNNE WRIGHT MCPEAK
Secretary

Attachment

Department of Transportation
Office of the Director
1120 N Street
P.O. Box 942873
Sacramento, CA 94273-0001

December 10, 2004

Sunne Wright McPeak, Secretary
Business, Transportation and Housing Agency
980 – 9th Street, Suite 2450
Sacramento, CA 95814

Dear Secretary:

I am pleased to provide our response to the Bureau of State Audits' (BSA) draft audit report entitled, "Department of Transportation: Various Factors Increased Its Cost Estimates for Toll Bridge Retrofits and Its Program Management Needs Improving." The report correctly concludes that the uniqueness of design and volatile markets for contractor services and materials coupled with schedule delays and higher contingency estimates have led to a large increase in estimated program costs. The report also reviews the Department of Transportation's (Caltrans) project management practices with primary focus on the East Span of the San Francisco Oakland Bay Bridge (SFOBB), and cites the need for improvement in those practices. This letter includes commentary on the overall content of the audit report, and a specific response to the recommendations contained in the document.

In summary, I believe that Caltrans has attempted to manage the Toll Bridge Seismic Retrofit Program (TBSRP) in a manner consistent with our standard practices, relying on our substantial experience in working on capital construction projects. For five of the toll bridges included in the TBSRP, Caltrans was able to complete the required retrofit of these bridges with a cumulative savings of $48 million as compared to the budget established in AB 1171. Notwithstanding this success, we acknowledge that there have been problems related to the design and construction of the SFOBB.

Caltrans is working hard to correct identified deficiencies in our management practices, and we appreciate the recommendations included in the BSA report that will assist in accomplishing that objective. To provide additional assistance in this effort, the Business, Transportation and Housing (BTH) Agency has engaged the services of a consulting group to review our practices and identify factors that have contributed to material cost increases for this project. However, we have also undertaken internal actions to provide for more cost-effective oversight, and I want to focus on these activities in this response.

Before commenting on these activities, however, I want to clarify the Caltrans' interpretation of cost overruns versus cost increases. The audit report repeatedly refers to overruns in the TBSRP. From our perspective, a cost overrun occurs after a project has been bid and a dollar amount allocated

to finance that project. By way of example, the need to add $249 million to the budget for the Richmond-San Rafael retrofit project after the initiation of construction constitutes a cost overrun. Prior to bid and award, higher budget projections for a project translate to cost increases. Higher projections for most of the east span projects that have not gone to construction have resulted in cost increases.

With that clarification, it should be noted that numerous actions have been taken to mitigate bid costs in excess of budgeted amounts for the TBSRP. When the bids came in over the engineer's estimate for the E2/T1 foundation project, Caltrans undertook several steps to reduce the cost of that project, and the resulting re-bid resulted in a $30 million cost savings.

When Caltrans determined that the AB 1171 budget might be exceeded if the main span bid came in significantly higher than the engineer's estimate, it initiated a review of all possible options to improve the bid package to reduce costs and to increase the potential for a bid within the AB 1171 limits. Numerous innovative management and contract requirements were applied to many of the TBSRP east span contracts to encourage strong bid competition, lower bids, and minimize costly delays during construction. Some of these include:

- Pier 7 of the Port of Oakland was obtained to provide office space for both Caltrans and the Contractor near the work site as well as facilitate materials to the work area. By providing this area, Caltrans has reduced contractor costs as well as provided for increased communication with the contractor for faster resolution of issues.
- A formal design campus was required for the Contractor and Caltrans to work together closely in the same office space to speed up the review and approval of time critical working drawings and requests for information. An additional payment item to facilitate this early cost to contractors was included. Plan approval delays can result in significant increases, especially on a project with 15,000 to 25,000 shop drawings.
- A separate demonstration pile contract was initiated to test constructibility of piles resulting in reducing bidder risk. The project identified risks that would have resulted in millions in cost from delay once construction had begun.
- A revised mobilization specification provides for revised schedule of and limits on payments for large and complex contracts. Also, a payment item was added to reduce the financing costs of contractors to mobilize marine equipment to access the work.
- A corridor value analysis specification added a process whereby contractors from projects along the east span corridor can meet with Caltrans to propose and discuss as a group ways to accelerate the overall project and reduce costs.
- Design elements were revised for the bridge design to address concerns with available marine equipment due to the hull restrictions of the Jones Act.
- Extensive review of welding specifications resulted in many revisions to improve constructability and incorporate lessons learned from claims on other projects.
- Earthquake liability was capped to limit risk for contractors for cost of damages should a seismic event occur.

- Low bids factoring in time as well as cost (A plus B bidding) were combined with incentives and disincentives to challenge and encourage the contractor to do the work as quickly as possible.
- Payment and performance requirements were reduced to an acceptable risk level. Caltrans advocated legislation to allow changes to this requirement.
- A bidder compensation stipend specification encourages more competitive bids and partially compensates them for the additional effort of preparing a bid.
- A table in the specifications was added to assist bidders in identifying submittals and their review times, thus keeping submittals off of the critical path. An additional payment item for accelerated working drawings was also added to limit delay during reviews.
- An intensive series of more than twenty-five informational and technical exchange meetings were held for prospective bidders, small businesses and disadvantaged businesses to enhance communication for constructability during the design and bid process.
- Anticipating bonding and insurance challenges, Caltrans sponsored a bill passed in 2003, AB 1745, that lowered bonding requirements for contractors on mega-projects such as the East Span.

Caltrans is committed to take whatever actions are necessary to achieve an efficient and cost-effective management structure that will ensure a high level of accountability for this important project, and we will continue to look for opportunities to accomplish this.

I also want to respond in some depth to statements in the audit report that because mandated statutory reports were not submitted on time, the Legislature was precluded from taking action to resolve the budget issue related to the TBSRP. Further, I want to correct the inference that Caltrans failed to disclose this information in an attempt to withhold cost information.

Admittedly, Caltrans did not provide certain required reports to the Legislature by the requisite due dates, specifically, the annual report due at the end of calendar year 2003 (Streets and Highways Code Section 188.5(d)(1); Chapter 327, Statutes of 1997) and the first two quarterly reports required under AB 1717 by Assembly Member Dutra (Chapter 525, Statutes of 2004). Although there is no justification for failure to provide timely reports to the Legislature, there are a few factors that mitigate the concern that the information was not available and that Caltrans was willfully withholding this material.

The essential information that would have appeared in the reports to the Legislature was provided in quarterly and annual reports to the California Transportation Commission (CTC), although none of these reports prior to May 26, 2004, indicated that Caltrans was projected to spend more than the budgeted amount included in AB 1171. Throughout calendar year 2003 and 2004, Caltrans briefings before the CTC clearly laid out the status of the program and public discussion took place over the concern that certain project bids exceeded engineers' estimates that were used to establish the AB 1171 budget for the program. In December 2003, the CTC reported to the Legislature in an annual report that TBSRP costs seemed likely to increase beyond the original estimate, perhaps even beyond the budgeted contingency fund. Specifically, the CTC indicated, "in September of 2003, Caltrans reported its latest cost estimate for the toll bridge seismic retrofit program at $4.932 billion, an amount that would require $295 million of the $448 million contingency…"

Moreover, the same CTC annual report referenced the BSA's August 2002 report on increased costs for the toll bridge seismic retrofit projects by stating, "As reported to the Governor and the Legislature by the State Auditor in August 2002, some increase now seems likely, perhaps even more than the designated $448 million in contingency funds."

With respect to the requirement contained in AB 1171 to report within 90 days if Caltrans determines that the actual costs of the program exceed the amounts appropriated for the seismic retrofit work, the audit report implies that Caltrans should have advised the Legislature as early as November of 2003 that costs for the TBSRP were in danger of exceeding the AB 1171 budget. The audit report references a November report to the Federal Highway Administration that cited upward pressures in the construction market pointing to cost increases in the program. However, at the time, this information was speculative, and Caltrans concluded that notification of the Legislature was not required since the budget had not been exceeded and aggressive cost mitigation strategies were being employed to bring the project in line with budget. While potential cost increases were a concern, nothing was known for certain until the bid opening for the Self-Anchored Suspension (SAS) main span on May 26, 2004. Until this time, Caltrans believed that, in the worst case scenario, a plan to provide a larger contingency might have been warranted.

Caltrans took appropriate steps to meet the statutory notification requirement when the bid for the main span project was opened in May of 2004. The Secretary of BTH joined Acting Director Tony Harris immediately after the bid opening for a media briefing to announce to the public that award of the SAS main span contract for the bid received would exceed the budget authority in AB 1711, and Caltrans initiated a revision of report material to inform the Legislature that costs for the program would exceed the AB 1171 budget.

Caltrans reported to BTH in mid-June that a re-analysis of the TBSRP showed a possibility of an overall program cost increase of up to $1.5 billion. After several preliminary meetings with Metropolitan Transportation Commission (MTC) in March through June of 2004, BTH and Caltrans met in July with MTC to develop a process for agreeing on estimates for the program going forward. It was agreed that Caltrans and MTC would work with Bechtel Infrastructure Corporation to reach consensus on project and program estimates so that a reliable funding package could be pursued and a joint funding proposal could be submitted to the Legislature.

At that time, the involved parties agreed that a complete review of all design options for the main span should be considered to see if the program could be brought back in line with the AB 1171 budget. It was not until the end of July that enough analysis on prospective costs and options had been conducted to conclude that there did not appear to be a way of completing the East Span within the legislative budget, regardless of design alternatives. On August 16, 2004, Caltrans submitted an updated status of the TBSRP to the Legislature. This document was intended to satisfy the requirements for submittal of a 2003 annual report and the first two quarterly reports for 2004 as required by AB 1717.

The timely submittal of statutory reports is an appropriate issue for BSA to raise. In fact, since my appointment as Director, I have implemented a monitoring system to provide information regarding report deadlines and to track the progress of report preparation. I have made it clear to my senior management that Caltrans will meet report deadlines and that I intend to hold managers responsible for complying with these requirements. However, while previous reporting requirements may not have been met, I am convinced that there was absolutely no intent on the part of Caltrans to withhold information on the status of the TBSRP. Nonetheless, it is also my intent to review the involvement of key personnel associated with this project to determine if there was any misconduct or negligence on the part of any individual in terms of meeting the requirements of the law. If it is determined that anyone was negligent in this regard, appropriate disciplinary action will be taken.

At this point, I would like to respond to the specific recommendations included in the audit report. The report identifies the following findings and recommendations:

Chapter 1: Volatile Markets for Contractor Services and Materials, Schedule Delays and Higher Contingencies Led to a Large Increase in Estimated Program Costs

This chapter generally covers the various reasons for cost increases and contains no recommendations.

Chapter 2: Caltrans Project Management Practices Need Improvement

This chapter covers several important aspects of project management and contains three recommendations.

Chapter 2 Recommendations:

1. To ensure that it properly manages the risks associated with these construction projects, Caltrans should continue to revise its risk management practices, but ensure that its efforts include the following:

   - Establishing comprehensive risk management plans that clearly define roles and responsibilities for risk management and address how Caltrans will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the life of the project.

   Caltrans Response:

   With the assistance of consultants, Caltrans has developed a *Report on San Francisco-Oakland Bay Bridge Quality Assurance and Risk Assessment*. Caltrans will designate a dedicated Project Risk Management Coordinator to support the Project Manager. The coordinator will:

1. Facilitate the Risk Response Team of knowledgeable personnel and consultants working on the SFOBB.
2. Regularly update, with the team, the risk assessment and prepare a risk response plan in accordance with Caltrans Project Risk Management Handbook.
3. Arrange and conduct quarterly meetings of the Risk Response Team to reevaluate the risks, revise the risk response plan, and determine whether the risk response plan is being followed. The Project Risk Management Coordinator and Project Manager will ensure that each person who is responsible for one or more of the risk responses is aware of and understands their responsibility.
4. Complete an updated risk response plan following quarterly meetings. The updated plan will be submitted to the Project Manager and Program Manager with an assessment of any changes in risks, the progress in following the previous month's risk response plan, and the status of the contingency reserve balance.

As part of Caltrans quarterly reporting process, the Program Manager will submit to the District Director, Chief Engineer, and Director the updated risk response plan that defines potential scope, cost, and schedule issues related to risks and mitigation measures.

- Quantifying the effect of identified risks in financial terms.

  Caltrans Response:

  1. In accordance with Caltrans Project Risk Management Handbook, the Risk Response Team will classify risks as "High Impact," "Moderate Impact" and "Low Impact" through a "Qualitative Risk Analysis."
  2. The Risk Response Team will estimate the most probable and credible financial impact of each high-impact risk, should it occur.
  3. Caltrans will utilize consultant and industry expertise as needed.

- Developing and maintaining documents to track identified risks and related mitigation steps.

  Caltrans Response:

  1. The Project Risk Management Coordinator will maintain records of the initial and quarterly revised assessments, qualitative and quantitative analyses, quarterly risk response plans, and assessments of progress in implementing the risk response plan.
  2. The Project Manager will incorporate the risk response plan in the evaluation of project budgeting and project control and monitoring activities.
  3. Caltrans will utilize consultant and industry expertise as needed to supplement this process.

2. To ensure that it follows generally accepted practices for cost management, Caltrans should do the following:

   - Regularly update its estimates of capital and support costs.

     Caltrans Response:

     1. Capital Outlay cost estimates will be updated annually during design.
     2. A revised Capital Outlay cost estimate (the "Engineer's Estimate") will continue to be prepared before each contract is advertised.
     3. Capital Outlay estimates will be updated by the Division of Construction quarterly for contracts in construction.
     4. Capital Outlay Support cost estimates will be updated quarterly by the Project Manager.

   - Regularly reassess its contingency reserves for potential claims and unknown risks, incorporating information related to risks identified and quantified through its risk assessment processes.

     Caltrans Response:

     1. In accordance with Caltrans' policies, the Division of Construction will assess the adequacy of the contingency reserve on each construction contract quarterly.
     2. The Project Manager will retain control of the budgeted contingency reserves for individual contracts. These reserves will be budgeted for contract risks that have been quantified and that are deemed highly likely to occur. Budgeting for risks will be coordinated with the Program and Project Managers.

   - Regularly integrate estimates for capital, support costs, and contingency reserves into a program-wide report.

     Caltrans Response:

     The Project Manager will report quarterly on the status of the contingency reserve balance as part of the updated risk response plan.

3. To ensure that it follows generally accepted management practices for communications management, Caltrans should do the following:

   - Submit quarterly status reports to the Legislature, as law requires.

     Caltrans Response:

     Caltrans agrees.

- Ensure that reports to the FHWA and other stakeholders reflect current data and provide an accurate representation of the program's status.

  Caltrans Response:

  Caltrans agrees.

- When key events occur, such as a bid opening for a major project, quickly inform stakeholders how these key events affect the overall program budget and schedule.

  Caltrans Response:

  The impact of these events on the budget and schedule will be reflected in the quarterly updates of the risk response plan, project status reports, and the statutorily required reports. In addition, updating will be reported to stakeholders immediately if warranted by significant events.

Caltrans appreciates the opportunity to respond to the Bureau of State Audits' Draft Audit Report. If you have any questions, or require further information, please contact Gerald Long, External Audit Coordinator, at (916) 323-7122.

Sincerely,

(Signed by: Lawrence H. Orcutt for)

WILL KEMPTON
Director

COMMENTS

California State Auditor's Comments on the Response From the Business, Transportation and Housing Agency

To provide clarity and perspective, we are commenting on the response to our audit report from the Business, Transportation and Housing Agency (agency). The numbers below correspond with the numbers we have placed in the margin of the agency's response.

● The concern raised in our report is not that the Department of Transportation (Caltrans) did not report any expenditure information but rather that Caltrans did not timely report an accurate status of the Toll Bridge Seismic Retrofit Program's (program) financial condition, including realistic estimates of future costs. As we note on page 52, the Caltrans director states that Caltrans prepared no program-wide update of the program's cost estimates between April 2001 and August 2004. Further, as we note on page 61 of the report, despite having to certify to the Federal Highway Administration (FHWA) that the cost data in its November 2003 financial plan update was accurate and provided a realistic estimate of future costs, Caltrans did not perform the work necessary to support this certification. As a result, we found that significant differences existed between the cost data Caltrans reported to FHWA in November 2003 and Caltrans' internal records.

● The definition of a cost overrun used in our report is the same as that used by Caltrans in its report to FHWA. When Caltrans provided detailed information to the federal government supporting its November 2003 financial plan update, it noted each instance in which a project's estimated cost exceeded budget as an "estimated cost overrun." For example, it characterized the signature span and Yerba Buena Island component of the San Francisco-Oakland Bay Bridge's east span (East Span) as having a $312 million estimated cost overrun even though a significant portion of this amount related to contracts for which Caltrans had not yet received bids.

- We did not make a determination whether Caltrans' failure to report on the program's status was "an attempt to withhold cost information." However, as we note in the discussion beginning on page 60 of the report, had Caltrans been diligent in its responsibilities, it should have known as early as November 2003 that the program was in financial trouble.

- Caltrans contradicts itself in this paragraph. Caltrans asserts that its briefings before the California Transportation Commission (commission) "clearly laid out the status of the program," which implies that Caltrans was reporting not only the program's expenditures, but also a realistic estimate of the program's future costs. However, earlier in this paragraph Caltrans states that none of its reports before May 26, 2004, indicated that Caltrans was projected to spend more than the budget in Assembly Bill 1171. As we note on page 61 of the report, despite having to certify to FHWA that the cost data in its November 2003 report was accurate and provided a realistic estimate of future costs, Caltrans did not perform the work necessary to support this certification. As a result, we found that significant differences existed between the cost data Caltrans reported to FHWA in November 2003, when Caltrans said project cost overruns would require $326 million of the program's $448 million contingency reserve, and Caltrans' internal records.

- Caltrans asserts that the bid opening for the signature span's superstructure, which represented $930 million of the $3.2 billion funding shortfall, was the driving factor for reporting cost overruns to the Legislature when in reality, other significant factors should have driven it to report sooner. Table 3 on page 19 shows cost overruns for the program: $564 million relates to the skyway; $1.348 billion relates to the signature span (which includes the $930 million increased cost estimate for the superstructure bid); $618 million relates to other East Span projects; $249 million relates to the Richmond-San Rafael Bridge; and $452 million relates to the need for additional program contingency reserves. Interspersed among the cost increases for specific projects is $556 million of additional support costs that were needed because Caltrans extended the program's length by four years. While we recognize that the bid for the superstructure was a significant event, it should not have been the driving factor for reporting to the Legislature.

- Caltrans says it had not conducted enough analysis until the end of July 2004 to conclude that the East Span would be over budget, however, there was sufficient information for it to have

conducted such an analysis in November 2003, if it had made the effort to accurately report to FHWA. For example, as we note on page 65, with the lengthened schedule for the East Span, Caltrans would have only had enough funds to pay for about one-and-a-half years of support costs at a time when it reported to FHWA in November 2003 that the program's schedule would extend for another eight years. In addition, in November 2003 Caltrans reported that it had committed all but $122 million of its program contingency reserve, despite the fact that it had not yet received a bid for the signature span's superstructure.

- Caltrans intent to time its future updates of cost estimates for projects under construction and for support costs with the legally mandated quarterly report is a good first step, but is inadequate given the program's $8.3 billion cost and its high risk. Based on its experience with the bid for the signature span's superstructure, annual updates of cost estimates for unbid projects may not provide up to date and relevant information. More frequent rather than less frequent updates of cost estimates would allow Caltrans management to be alerted of problems sooner and be able to implement corrective action as well as notify stakeholders well in advance before cost overruns soar out of control. As we note on page 52, FHWA strongly recommends development of a monthly report with current cost forecasts. Moreover, to meet its mandate under state law to report to the Legislature when it determines that the program's actual costs exceed the budget, would necessitate more frequent internal monitoring of the program's expenditures and estimated projected costs so that it can appropriately make this determination. In contrast to Caltrans' intended corrective action, we note on page 70 that for programs under the Regional Measure 1 Program, the commission receives monthly reports from its oversight consultant on the cost and schedule status of each project. These reports provide a mechanism to promptly alert the commission to potential cost and schedule problems with the program.

- Caltrans appears to miss the intent of our recommendation. We agree with Caltrans that it is important to reassess the contingency reserve for individual projects, however, as noted on pages 50 and 55, it is also important for Caltrans to reassess the sufficiency of the contingency reserve for the entire program based on risks identified and quantified through its risk assessment process. In addition, it is important for Caltrans to reassess contingency reserves for construction contracts that

have not yet been bid and to determine reserves for awarded contracts where additional costs are quantifiable and probable, not just where they are deemed highly likely to occur.

Agency's comments provided as text only.

Bay Area Toll Authority
101 Eighth Street
Oakland, CA 94607-4700

December 10, 2004

Ms. Elaine M. Howle
State Auditor
Bureau of State Audits
555 Capitol Mall, Suite 300
Sacramento, CA 95814

Dear Ms. Howle:

Thank you for an opportunity to review portions of the draft report titled "Department of Transportation: Various Factors Increased its Cot Estimated for Toll Bridge Retrofits and Its Program Management Needs Improving." Based on our review, we believe that your staff has completed an extensive and thorough review of the toll bridge seismic program.

Based on our discussions with your staff, we understand that most of our comments have been incorporated into the report. We look forward to receiving the full report when it is completed.

If you need any additional information, please call me at 510-464-7801 or Rod McMillan of my staff at 510-817-3260

Sincerely,

(Signed by: Ann Flemer)

Ann Flemer
Deputy Director, Operations

cc: Members of the Legislature
Office of the Lieutenant Governor
Milton Marks Commission on California State Government Organization and Economy
Department of Finance
Attorney General
State Controller
State Treasurer
Legislative Analyst
Senate Office of Research
California Research Bureau
Capitol Press

California State Auditor

BUREAU OF STATE AUDITS

Department of Transportation

Toll Bridge Seismic Retrofit Program

Presentation by

Elaine M. Howle
California State Auditor

January 24, 2005

This presentation document is only intended to outline selected portions of the report. For a more complete explanation of the points outlined in this document, please refer to the report.

Report 2004-140 ***Department of Transportation: Various Factors Increased Its Cost Estimates for Toll Bridge Retrofits, and Its Program Management Needs Improving*** **(December 2004)**

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AUDIT SCOPE

BACKGROUND INFORMATION

Compared cost estimates prepared under AB 1171 (Chapter 907, Statutes of 2001) and those supporting Department of Transportations' (Caltrans) August 2004 report and reviewed the methodology for estimating capital and support costs.

Focused on the East Span of the San Francisco-Oakland Bay Bridge and the Richmond-San Rafael Bridge because these projects accounted for 99 percent of the cost increases for specific bridges.

- Analyzed cost changes on these projects to determine where significant variances occurred and whether these cost factors were unforeseen at the time of AB 1171.

Interviewed Caltrans staff and program managers and evaluated documentation to ascertain the reasons for the increases.

Examined supporting documentation for Bechtel Infrastructure Corporation's (Bechtel) August 2004 cost review of the program.

Compared program cost increases and their causes with those that occurred in similarly large projects managed by Caltrans for Bay Area Toll Authority's (BATA) measure 1 program.

Compared Caltrans management of the program to project management best practices as described in the Project Management Body of Knowledge, Federal Highway Administration (FHWA) guidance for major projects, and Caltrans' internal project management handbooks.

Focused on management of risk, cost, and communications with external stakeholders.

- **Risk management:** Evaluated Caltrans' risk management planning and its processes for risk identification, quantification, mitigation, and tracking for the East Span.

- **Cost management:** Ascertained whether Caltrans regularly prepared program-wide estimates of costs and contingency reserves and kept them updated.

- **External communications:** Ascertained whether Caltrans regularly supplied updated and reasonably accurate reports, incorporating estimates of project costs and contingency reserves, of the status of the overall program, to critical stakeholders—the Legislature, FHWA, and the Metropolitan Transportation Commission (commission).

AUDIT HIGHLIGHTS

Cost estimates have increased $3.2 billion since April 2001, including a $900 million program contingency reserve.

- ☑ Caltrans' 2001 cost estimate amounted to $5.1 billion, including a $448 million program contingency reserve to cover unforeseen costs. At that time, Caltrans projected that the program would be completed in 2009.

- ☑ In August 2004, Caltrans informed the Legislature that the program could cost $8.3 billion—$7.4 billion for specific projects and a $900 million contingency reserve for possible cost increases on those projects—and would be completed no sooner than 2013.

Approximately $930 million of the $3.2 billion increase relates to the May 2004 bid for the superstructure of the signature span of the San Francisco-Oakland Bay Bridge's east span; the remainder is attributable to other cost categories.

Various factors have driven cost increases including volatile markets for steel and contractor services, a lengthening of the East Span's timeline, and Caltrans' past experience with the program, which is reflected in contingency reserves.

Caltrans neglected several important aspects of generally accepted standards for project management. Specifically:

- ☑ Caltrans did not create a comprehensive risk management plan for the East Span, and lacked processes to identify, track, and quantify risks throughout this project's life.

- ☑ Caltrans did not regularly update its cost estimates for some components of the East Span or the entire program. Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide update of cost estimates since April 2001.

- ☑ Caltrans failed to disclose information to the Legislature according to the law's regular reporting schedule and disclosed huge cost overruns long after it should have been aware of them.

- ☑ In November 2003, Caltrans' financial plan update to the FHWA did not reveal the probable extent of estimated program costs. At that time, based on internal reports, Caltrans should have known that the program was over budget.

Various Factors Have Dramatically Increased Estimated Costs

RISING COSTS AND DELAYS PLAGUE COMPLETION OF THE STATE'S LARGEST PUBLIC SAFETY PROJECT

Caltrans' 2001 estimates formed the basis for the program budget the Legislature adopted in AB 1171. In August 2004, Caltrans reported to the Legislature cost estimates that were $3.2 billion, or about 63 percent higher, than the estimates it prepared in April 2001.

Caltrans reevaluation of program costs was triggered in May 2004 by receiving the sole bid for the signature span's superstructure, which exceed Caltrans' 2001 estimate by $930 million.

After this event, the commission hired Bechtel to review Caltrans' estimate of costs to complete the program. Bechtel agreed on a program cost estimate of $8.3 billion, including a $900 million program contingency reserve.

As Table 3 on the following page shows, the revised cost estimate for individual toll bridges was about $2.8 billion more than the cost estimates used for AB 1171, while the program contingency rose by $452 million.

Of these increases, Caltrans estimates that about $2.5 billion relates to higher costs for the East Span.

The small variances for the remaining five bridges in the table were not surprising because these bridges were substantially complete when Caltrans recalibrated the program budget in 2001.

Most of the Program's Significant Increase in Cost Estimates and Program Delays Relate to the East Span

- More than 90 percent, or $2.5 billion, of the cost increase for specific bridges relates to the East Span replacement project, which has a number of components, including the signature span, the skyway, and the demolition of the existing bridge.

- The cost estimate for the signature span rose by more than $1.3 billion, or 162 percent.

- The cost for the skyway component that remained in the East Span design rose by $564 million, or 61 percent.

- The remainder of the East Span composed of 12 components rose by $618 million, or 73 percent.

In total, it appears that the East Span costs, including amounts related to the program contingency, total about $5.9 billion.

TABLE 3

The Toll Bridge Seismic Retrofit Program Has Experienced Significant Increases in Projected Costs (Dollars In Millions)

Toll Bridges	AB 1171 Estimate	Caltrans' August 2004 Estimate	Projected Cost Increase/(Decrease)	Percentage Increase/(Decrease)
San Francisco-Oakland Bay Bridge				
Skyway	$ 926	$1,490	$ 564	61%
Signature span	830	2,178	1,348*	162
Other East Span projects†	844	1,462	618	73
Subtotals, East Span Replacement‡	**2,600**	**5,130**	**2,530**	**97**
West Span Retrofit and Approach Replacement§	700	737	37	5
San Francisco-Oakland Bay Bridge Totals	**3,300**	**5,867**	**2,567**	**78**
Richmond-San Rafael Bridge‖	665	914	249	37
San Mateo-Hayward Bridge#	190	165	(25)	(13)
Benicia-Martinez Bridge#	190	180	(10)	(5)
Carquinez Bridge#	125	115	(10)	(8)
San Diego-Coronado Bridge#	105	105	0	0
Vincent Thomas Bridge#	62	59	(3)	(5)
Subtotals, Project Specific	**4,637**	**7,405**	**2,768**	**60**
Program Contingency	448	900	452	101
Grand Totals	**$5,085**	**$8,305**	**$3,220**	**63%**

Sources: Chapter 907, Statutes of 2001 (AB 1171), and the Caltrans August 2004 report.

* The signature span projected cost increase is comprised of $930 million related to the sole bid for the superstructure, $146 million related to support costs, $122 million related to increased reserves, $100 million related to other contracts, and $50 million related to miscellaneous items.

† Other projects needed to complete the East Span, including the South/South Detour, Yerba Buena Island structures, Oakland Touchdown, and the demolition of the existing bridge.

‡ The East Span construction is 25 percent complete as of the Caltrans August 2004 report.

§ The West Span retrofit is 100 percent complete and the West Approach construction is 25 percent complete as of the Caltrans August 2004 report.

‖ Bridge retrofit is 85 percent complete as of the Caltrans August 2004 report.

Bridge retrofit is 100 percent complete as of the Caltrans August 2004 report.

In August 2004, Caltrans expected the program to be completed by 2013, four years later than it estimated in 2001. This delay can be attributed almost entirely to the signature span.

Caltrans postponed the bid opening five times during the advertisement period to allow bidders more time to prepare their bids, which delayed the project by almost one year.

Caltrans also agreed to give contractors three more years than it originally envisioned to complete their work to attract as many bidders as possible and to address potential bidders concerns about the time needed to construct the signature span superstructure.

VARIOUS FACTORS CONTRIBUTED TO THE HIGHER COST ESTIMATES AND DELAYS

The multiplicity of factors, along with the limited access Caltrans has to the proprietary data that supports contractors' bids, makes it difficult to attribute dollar effects to specific causes.

According to standard provisions in Caltrans' contracts for the program, a contractor must submit all documentary information used in preparation of its bid.

> Caltrans has only 48 hours after receipt to examine the bid documentation to make sure it is authentic, legible, and includes the necessary documentation to support the bid before sealing it and depositing it in an agreed upon commercial bank for storage.
>
> After this point, Caltrans and the contractor may retrieve and jointly review the bid documentation in order to assist in the negotiation of price adjustments and change orders or to assist in the resolution or settlement of claims or disputes.

Caltrans could not provide detailed support for the increased costs it attributed to particular factors in its communications with the Legislature in August 2004. Caltrans stated that the amounts were based on professional judgment and that there was no documentary support that identified the methodology or calculations attributed to each factor.

Nevertheless, when we compared Caltrans' two cost estimates, from 2001 and 2004, we found that much of the program's cost increases occurred in several areas such as structural steel, contractor overhead, and support costs.

Categories with the most significant cost increases include:

- Contractor overhead.
- Structural steel.
- Contingency reserves for the East Span's skyway and signature span.
- Support costs for the East Span.
- Program contingency reserves.

We reviewed cost categories for the skyway, signature span, and the Richmond-San Rafael Bridge projects and our analysis points to the following market and project developments that led to higher estimates for these cost categories:

- Higher steel prices.
- Lengthened schedules that increase the need for contractor overhead and Caltrans support.
- Escalation that Caltrans did not apply to the entire life of the projects at the time of AB 1171.
- Difficulties with underwater work.
- Recognition of significant continuing risk that led to increased contingency reserves.

Table 4 on the following page shows that a few types of costs account for most of these projects' cost increases.

TABLE 4

Amounts of Increases in Various Cost Categories (In Thousands)

	San Francisco-Oakland Bay Bridge			
	Skyway	Signature Span	Skyway and Signature Span	Richmond-San Rafael Bridge
Cast-in-place concrete	$ 27,026	$ 52,453	$ 79,479	$ 321
Core concrete/drill and bond/ prestressing	8,683	4,476	13,159	1,878
Environmental preservation	2,286	279	2,565	210
Excavation and cleanup	8,125	136	8,261	21,855
Marine access	NA*	43,000	43,000	NA
Micropiles	NA	NA	NA	14,211
Other materials and services	(72)	10,458	10,386	1,750
Contractor overhead	178,187	406,769	584,956	11,455
Pilings	23,007	5,010	28,017	11,577
Precast concrete	51,647	NA	51,647	1,931
Removal and demolition	NA	1,200	1,200	271
Roadway	(390)	4,284	3,894	NA
Seismic safety	8,757	10,337	19,094	641
Structural steel and miscellaneous metal	99,605	498,332	597,937	35,830
Temporary items	2,186	NA	2,186	253
Traffic control and safety	286	(1,498)	(1,212)	3,082
Utility work and services	2,122	20	2,142	928
Water pollution control measures	(225)	NA	(225)	173
Reserves	85,872	121,623	207,495	107,657
Other items†	761	45,199	45,960	(4,023)
Subtotals, Capital outlay increases	**$497,863**	**$1,202,078**	**1,699,941**	**210,000**
Capital outlay increases other East Span projects			334,000	
Support cost increases for East Span			496,000	
Support cost increases for Richmond-San Rafael Bridge				39,000
Totals, Project Cost Differences			**$2,529,941**	**$249,000**

Sources: Caltrans' April 2001 and August 2004 cost estimates.

NA = Not applicable.

* Marine access was a separate category in the skyway estimate used for AB 1171, but the item was included under the contractor overhead category in the project bid.

† Other items include supplemental work, state-furnished materials, and minor differences.

Volatile Market Conditions Contributed to Cost Increases for Materials

Structural steel items greatly increased from the AB 1171 estimate made in 2001 to the May 2004 contractor's bid.

> Caltrans saw a $498 million, or 137 percent, increase in the cost of structural steel items for the signature span.

Part of this increase is attributable to a significant increase in the price of structural steel in the first half of 2004.

According to an industry index that Caltrans engineers use to monitor steel price fluctuations, the industry experienced a 26 percent increase in structural steel prices in the first half of 2004.

> We applied this percentage to the AB 1171 estimate of $365 million in structural steel costs for the signature span to get a rough idea of its impact on materials costs, and the computation yields $95 million in extra structural steel costs.

Although steel prices played a part in rising costs, increases in some bid items are well over what can be explained by a general increase in steel prices.

- At the time of AB 1171, when the bridge design was about 65 percent complete, Caltrans estimated that temporary towers would cost $10 million. The 26 percent increase in structural steel prices in the first half of 2004 would increase this estimate to $12.6 million.

- However, in April 2004, after the sharp increase in steel prices, Caltrans' internal estimates indicated that the probable bid amount for the temporary towers would be nearly $70 million.

- In the single bid Caltrans received in May 2004, the temporary towers were estimated at $215 million, far beyond the amount by which higher steel prices would have increased the cost.

We asked Caltrans to explain the significant increase, specifically questioning whether a portion of it could be explained by a difference in quantity.

> According to the director, the consulting firm used to estimate the cost and materials for the temporary towers verified that its quantity estimates are still valid.
>
> Caltrans indicated that the higher than expected bid amount is due to a number of factors including:
>
> - The bidder may have included in that amount the costs for the heavy equipment used to lift the deck into place instead of putting those costs in other line items.

- The bidder may have incorporated an amount to reflect risk related to how long the temporary towers would have to support the permanent work.

- Cash flow may have played a role. The bidder may have moved amounts from another line item into the temporary tower line item in order to receive contract payments earlier.

Caltrans Underestimated the Contractor's Overhead as a Share of Construction Costs

In estimating costs for the East Span's skyway and signature span, Caltrans underestimated the contractor's overhead as a proportion of total project capital costs.

The signature span and the skyway bids included separate lump-sum amounts for time-related overhead and mobilization.

> Caltrans defines time-related overhead as the daily cost for the contractor's field and home office managerial and administrative staff as it relates to the number of days needed to complete the contract.
>
> Caltrans defines mobilization as the cost of moving laborers, tools, construction equipment, construction materials, and incidentals to the project site; establishing offices, buildings, and other facilities necessary for work on the project.

The contractors' bids for time-related overhead for the skyway and signature span of the East Span were much higher than Caltrans anticipated.

- **Skyway:** $208 million, or 235 percent higher

- **Signature span:** $243 million, or 501 percent higher

Caltrans calculates overhead costs as a percentage of capital costs and applied a rate of 10 percent to East Span projects. However, rates for time-related overhead for the two projects in the August 2004 estimates are much higher—20 percent for the skyway and 15 percent for the signature span.

The director states that Caltrans believes that market conditions after September 11, 2001, have led to higher insurance and bonding costs, and greater scrutiny of risk on large projects, which has contributed to higher time-related overhead bid amounts.

Longer Project Timelines and Delays Also Played a Role in Higher Costs

Caltrans' meetings with potential bidders resulted in 26 addenda to the proposed contract to address issues that contractors raised, such as the level of liquidated damages imposed in the contract, the three-year contract period, and various cash flow issues.

Five addenda added more than three years to the time allowed for contract completion.

Considering that the addenda doubled the length of time for construction, a large increase in time-related overhead could be expected.

Additionally, mobilization was a major factor in increased overhead costs for the signature span.

- **Skyway:** $99 million, or 45 percent higher
- **Signature span:** $233 million, or nearly 411 percent higher

The East Span project manager attributed higher mobilization costs for the signature span to the fact that Caltrans increased contractual mobilization payments to relieve cash flow constraints on contractors and to mitigate the costs of financing.

Increases in Estimates for Caltrans' Support Costs Contributed Significantly to Overall Program Costs

Support costs for Caltrans' administration of the program increased significantly, accounting for $556 million, or 20 percent, of overall cost increases before program contingencies.

> Support costs include staff salaries, consultant fees, and other operating costs of administering construction activities involved in retrofitting the toll bridges.

Time delays and extensions also offer an explanation for why support costs would be expected to increase.

Support cost estimates under AB 1171 in 2001 extended through 2007; however, the August 2004 estimate accounts for support costs through 2012.

> Caltrans' expenditures for support costs averaged about $8 million per month for the 12-month period ending October 2003. Using this same monthly rate over the additional five years included in the August 2004 estimate could account for roughly $480 million of the $556 million increase in the program's support costs.

Caltrans Underestimated Price Escalation

For large construction projects that extend over a period of time, estimates need to build in escalation rates for inflation over a project's life.

Caltrans applied an annual escalation of 5 percent into its AB 1171 estimates up to the time that it expected to receive contract bids, but not for the construction phase.

To reflect inflation that would occur during construction, Caltrans should have extended its escalation calculations to cover the expected time to complete these components.

For the skyway and signature span, escalating costs through the mid-point of the expected construction period would have yielded an AB 1171 estimate that may have been approximately $69 million and $70 million higher, respectively, than the Caltrans' figure.

Similarly, inflating capital cost estimates under AB 1171 for the four-year extension could account for up to $110 million of the signature span cost increase.

Underwater Work Increased Costs for the Richmond-San Rafael Bridge

Underwater debris discovered after construction began, deeper than expected bedrock at several locations, and lack of clearance for driving micropiles have challenged the contractor working on the project.

Caltrans accumulated $47.6 million in additional costs related to underwater work on the Richmond-San Rafael Bridge, including $22 million to remove underwater debris.

Conditions related to the piling work have resulted in a number of project change orders totaling $11.6 million.

Change orders related to micropile work have cost Caltrans more than $14 million over contracted amounts.

The Program's Contingency Reserves for Potential Cost Increases Remain High

Caltrans looks to its contingency reserves to cover unforeseen costs and potential claims related to identified problems, generally establishing a contingency reserve for each project and sometimes a program-wide contingency reserve.

The contingency reserve amounts that Caltrans built into its August 2004 cost estimates for the skyway, signature span, and the Richmond-San Rafael Bridge remain substantial, sometimes even above AB 1171 cost estimates in terms of the percentage of capital costs they represent.

The $900 million contingency reserve represents the level Bechtel concluded was necessary to provide an 80 percent assurance that costs would not exceed Caltrans' August 2004 cost estimate.

With Continuing Uncertainties, the Program's Costs May Rise Further

The August 2004 estimates assumed that Caltrans would accept the bid for the signature span superstructure and thus keep the program on schedule.

In August 2004, Bechtel indicates it reviewed Caltrans' analysis of bid options for the superstructure, which indicated that project costs would increase if the superstructure was readvertised and rebid, or redesigned.

> Bechtel was careful to say that its review was not a detailed estimate of program costs and that it did not perform a value engineering analysis. It used information provided by Caltrans and the Bay Area Toll Authority but did not independently verify that information.

In September 2004, Caltrans, with a preliminary review by Bechtel, developed a cost estimate for rebidding a skyway design to replace the signature span.

> Before considering other factors such as schedule delays and the cancellation and modification of existing contracts, this estimate indicates that a skyway design would cost $665 million less than the signature span.
>
> However, Caltrans estimated that costs associated with the other factors would largely offset this gain, yielding either savings of $255 million or additional costs of $140 million.

On December 10, 2004, Caltrans published a study that recommended either completing the signature span as originally designed or extending the skyway across the East Span.

We requested supporting schedules supporting Caltrans' cost figures, as well as its reconciliation of costs to its August 2004 report to the Legislature. Because we did not receive the schedules from Caltrans with sufficient time to review them prior to publishing this report, we were unable to analyze the cost figures in this study.

Caltrans' Project Management Practices Need Improvement

- ☑ Caltrans neglected several important aspects of project management that could have helped it maintain realistic and up-to-date estimates of program costs and risks, and communicate those estimates in a timely manner.

- ☑ Caltrans had numerous early indications that the program would exceed the AB1171 budget.

- ☑ Caltrans did not develop a comprehensive risk management plan for this project.

- ☑ Although Caltrans identified certain risks through various analyses, it has not performed some of the major processes—planning, tracking, and quantifying—necessary to maximize the chances of positive rather than adverse events in the East Span project.

- ☑ Caltrans did not regularly update its costs estimates for the East Span project or the entire program, including updating estimates for capital costs, support costs, and contingency reserves, which should cover the cost of known potential risks and unknown risks.

- ☑ Caltrans has not paid enough attention to communications management, failing to inform its major stakeholders such as the Legislature and the commission of potential cost overruns.

Although Caltrans Has Some Risk Management Activities in Place, It Lacks a Comprehensive Risk Management Plan

Contrary to generally accepted practices and its risk management handbook, Caltrans did not create a risk management plan for the East Span.

> Such a plan defines various risk management processes and how often they will be used throughout the project, so that results of risk analyses can be developed early enough to affect decisions.

In a February 2003 report, a consulting firm Caltrans hired to perform a quality assurance check and risk assessment of the estimated construction schedule for the East Span, warned that the East Span project's complexity and uniqueness warranted an increased risk management effort.

The consultant stressed that an essential part of risk mitigation for the project would be to form a risk management team fully dedicated to this project that not only manages risks associated with the signature span, but also coordinates and manages risks for the overall project.

Moreover, the consultant warned that if a risk management team and other mitigation strategies for technical issues were not implemented, it was highly unlikely that Caltrans could complete the East Span by the then-expected completion date of 2008.

In response to the consultant's recommendations, Caltrans indicates that the risk assessment group is responsible for risk management for the project and that a group of managers meets quarterly to identify and discuss mitigation strategies for construction risks related to the East Span.

Having these groups is a good first step in addressing risk management issues for the project; however, neither group undertook planning for all the processes that best practices dictate are needed to manage risks.

> For example, the risk assessment group does not plan how risk management activities will systematically address risk identification, quantification, or tracking over the project's life.

Caltrans used a status report to track risk activities, but stopped it in January 2003, even though one of the action items in the report was to develop and maintain this program-wide status report to update issues and action items.

Caltrans Took Steps to Identify, Prioritize, and Mitigate Project Risks

Despite its lack of a comprehensive risk management plan, Caltrans took several steps to systematically identify, rank, and respond to the East Span project's risks.

In March 2002, a Caltrans consultant performed a constructibility review study to identify errors, omissions, and inconsistencies in its construction documents and specifications, as well as to develop ways to improve contractors' ability to construct the project.

Caltrans also initiated a quality assurance review by the Caltrans Central Region, issued in December 2002, that primarily analyzed the cost estimate for the signature span and secondarily focused on the remaining East Span contracts not under construction.

- Among other things, the Central Region recommended that Caltrans increase the cost estimate for the signature span to $800 million to better reflect unknowns.

- It also recommended that Caltrans pursue a waiver of the federal regulations requiring the use of domestic steel, which it claimed would have a substantial effect on the costs for the steel tower and other components.

In October 2003, Caltrans formed an independent review committee of consultants to review the contract requirements for two major East Span contracts—the signature span and its foundations—before advertisement.

Caltrans Did Not Adequately Quantify Risks Associated With the Project

Although Caltrans acted to identify, qualitatively analyze, and mitigate risks that could affect the East Span, it did not have a coordinated risk management plan in place to ensure that it quantified risks in terms of increased costs to the project.

Three of five analyses Caltrans initiated quantified risk in terms of potential cost; however, Caltrans did not use these quantified risks to update its cost estimates.

> According to the summary of risk management activities Caltrans prepared for us, Bechtel's August 2004 cost review was the only program-wide quantitative risk analysis performed for the program since AB 1171 was passed.

The December 2002 quality assurance review recommended contingency reserves of at least 20 percent; however, Caltrans' internal estimates for the signature span contracts included only a 5 percent project contingency reserve.

CALTRANS DOES NOT REGULARLY UPDATE PROGRAM COST ESTIMATES TO MONITOR THE PROGRAM'S BUDGET APPROPRIATELY

We reviewed Caltrans' performance on two key elements of project cost management—cost estimating and cost control.

Under AB 1171, the Legislature gave Caltrans a budget of approximately $5.1 billion, including a $448 million program contingency reserve. However, Caltrans has not updated the projected program costs regularly to assess whether it is staying within the budget that AB 1171 established.

> In particular, Caltrans has not regularly updated its estimates of support costs needed for the life of the program and has not reassessed its program contingency reserve.

Caltrans Does Not Regularly Update Cost Estimates for the Whole Program

Although it prepares monthly estimates of costs on projects under construction, Caltrans lacks a regularly updated overview that includes actual costs, anticipated costs, and contingency reserves from a program-wide perspective.

Caltrans' project management handbook notes that effective cost management requires project managers to regularly compare actual expenditures to planned expenditures at the level used in budget development.

Further, the FHWA strongly recommends development of a monthly cost, schedule, and status report, including a current cost forecast compared with the latest budget, with an explanation for budget deviations.

Caltrans' cost update for the August 2004 report to the Legislature was its first program-wide update of cost estimates since Caltrans prepared the cost estimates for AB 1171 in April 2001.

Caltrans Did Not Regularly Reevaluate the Program's Support Costs

Proper tracking of support costs is important because they represent 17 percent of the program's budget that AB 1171 established in 2001.

Until recently, Caltrans did not regularly track whether its support costs, set at $796 million in AB 1171, were projected to stay within budget.

As of October 2003, Caltrans' accounting records showed that it had spent $612 million in support costs since the program began. In November 2003, Caltrans reported to the FHWA that it was reducing its support cost budget to $766 million, leaving only $154 million to pay support costs through 2011.

At its 2003 usage rate of $8 million per month, Caltrans would have spent its remaining support costs budget of $154 million by June 2005.

According to the project control manager, the project control unit for Caltrans' District 4 Office prepared a detailed estimate of total support costs needed for the remainder of the program in March 2004, but he was not aware of Caltrans completing such estimates for fiscal years 2002–03 and 2003–04.

Caltrans Had Not Regularly Reevaluated the Program's Contingency Reserve Nor Accounted for Potential Cost Increases

Caltrans' August 2004 report includes the first reevaluation of the program's contingency reserve since AB 1171 became law in October 2001. Yet, during this three-year gap, Caltrans had several signs that its program contingency reserve was insufficient to cover cost overruns.

In addition, the Caltrans' cost estimates initially drawn up for the August 2004 report significantly underestimated the program's cost.

A joint effort by Caltrans, Bechtel, and the commission increased Caltrans' May 2004 cost estimate of $6.8 billion to $8.3 billion, including a $900 million contingency reserve.

According to supporting documentation for Bechtel's August 2004 cost review, Caltrans did not account for $452 million in potential future capital costs associated with adjustments to reflect increased prices for steel and concrete, contractor's time-related overhead and mobilization, and escalation costs for several projects.

Caltrans Generally Follows Its Internal Contract Change Order Policies

Caltrans issues change orders to make changes to original contracts, paying for changes with contingency reserves.

Caltrans complied with its internal policies and procedures when we reviewed a sample of 20 change orders with a value greater than $1 million for the Richmond-San Rafael Bridge and skyway projects and greater than $300,000 for the West Approach project.

Caltrans also performed an appropriate assessment of each change order's impact on the overall project.

CALTRANS DID NOT EMPLOY GOOD COMMUNICATIONS MANAGEMENT, RESULTING IN THE FAILURE TO REPORT COST OVERRUNS TO STAKEHOLDERS IN A TIMELY FASHION

Caltrans failed to keep its stakeholders informed of relevant changes in its estimates of program costs and cost overruns on a reasonable and timely basis.

Although state law requires regular reporting to the Legislature, Caltrans did not provide a status report on the program for 2003 or the first half of 2004 until August 2004.

- ☑ Caltrans had strong indications that the program's costs would exceed the AB 1171 cost estimates as early as November 2003 when it provided its annual financial plan to the FHWA.

- ☑ Caltrans' financial plan contained information that did not reflect its internal cost estimates, and thus understated the extent of the cost overruns.

- ☑ Caltrans provided no information on potential program funding shortfalls before May 2004 to the commission, a critical stakeholder that represents the commuters who pay to use the toll bridges.

Caltrans Failed to Report the Program's Status and Cost Overruns to the Legislature, as State Law Requires

Although state law requires Caltrans to periodically report the program's status and notify the Legislature of program cost overruns, Caltrans did not report cost overruns it should have known of until they were staggering.

With the sole bid for the signature span's superstructure expiring on September 30, 2004, Caltrans gave the Legislature about six weeks to develop a funding solution to the $3.2 billion cost overrun.

Through 2003, the Streets and Highways Code required Caltrans to provide program status reports annually; beginning in 2004 the law was changed to require quarterly reports. These quarterly reports are supposed to include the following items:

- The status, including details, of each toll bridge project.
- The baseline budget at the time of AB 1171.
- An updated budget and expenditures to date for support and capital outlay costs.
- A comparison between the baseline and the updated budget.
- A summary of milestones achieved, issues identified, and actions taken to address those issues.

The code also requires that if Caltrans "determines that the actual costs exceed the [budget provided in AB 1171 Caltrans] shall report to the Legislature within 90 days from the date of that determination as to the difference and the reason for the increase in costs."

> However, Caltrans submitted no status report for 2003 or the first half of 2004 until it reported in August 2004 that the program's costs could greatly exceed its funds.

Caltrans intended to include the status information for 2003 in its first quarterly report for 2004; however, it also made a conscious decision that given the imminent bid opening of the contract for the signature's span's superstructure due on May 26, 2004, and the dynamics of the bidding environment and market prices for steel and concrete, submittal of a quarterly report in May 2004 would lack meaningful detail to report.

Caltrans Should Have Known Significant Cost Overruns Were Likely When It Reported the Program's Status to the Federal Government in November 2003

Under federal law entities receiving federal funds for a project with an estimated cost of $1 billion or more must submit a financial plan by November 15 of each year to FHWA.

Caltrans' financial plan that it submitted to the FHWA in November 2003 showed that the program's projects were exceeding AB 1171 cost estimates and that there was less than a 3 percent program contingency reserve remaining to fund any further cost overruns for a program that was eight years from completion.

Caltrans' financial plan caused FHWA to question several issues regarding the program's funding. In addition, the FHWA financial manager told us that she emphasized to Caltrans executives during project meetings and communications the importance of disclosing knowledge of potential cost overruns to the federal government and other stakeholders.

In January 2004, FHWA sent a letter to Caltrans with its concerns. In February 2004, Caltrans supplied FHWA a breakdown of program costs, indicating the program had total cost overruns of $563 million.

Caltrans told FHWA that it would use $237 million in projected savings and $326 million from the $448 million in program contingency reserves to pay for these cost overruns. However, these savings had almost evaporated by the time Caltrans reassessed the program's viability for its August 2004 report.

Six months after Caltrans' February 2004 letter to FHWA asserted that the program contingency reserve of $122 million was sufficient, it reported to the Legislature that the program was over budget by $3.2 billion.

Caltrans' Estimate for Support Costs for the Remaining Eight Years of the Program Was Understated Significantly

In its November 2003 report to FHWA, Caltrans indicated that its program support costs would total $766 million, a $30 million reduction. However, as of October 2003, Caltrans accounting records showed that it had spent $612 million in support costs since the program began, leaving only $154 million to pay support costs through 2011.

At its usage rate of $8 million per month in 2003, the $154 million would have lasted little more than one-and-a-half years; therefore, no resources would then be available for the remaining six-and-a-half year period of June 2005 through December 2011.

If Caltrans had assumed a usage rate for the six-and-a-half year period, it would have computed that it needed an additional $624 million for a total of roughly $1.4 billion. When it finally performed an analysis of future support costs for its August 2004 report, the revised estimate totaled $1.352 billion.

Caltrans' Internal Estimates for the Signature Span's Superstructure Showed the Potential for Increased Costs Well Before the May 2004 Bid Was Received

Caltrans' internal estimates for the cost of the signature span's superstructure also were increasing and should have led Caltrans to alert the Legislature that program costs would be higher than the AB 1171 estimates.

Internal analyses show that Caltrans had indications that its "call-out number" (used to give bidders a general idea of the contract's scope) of $733 million was understated significantly.

Table 7 on the following page shows that based on a consultant's mock bid, there were indications as early as August 2002 that the superstructure bid could be as high as $934 million.

In December 2003, the assigned Caltrans bridge cost estimating specialist computed an estimated cost of $1.036 billion.

Further, in April 2004 shortly before the bid opening, an internal estimate of the bid amount was nearly $1.3 billion, which is slightly less than the actual bid amount of $1.4 billion.

TABLE 7

Timeline of Estimates for the Signature Span's Superstructure

Basis for Estimate	Date	Amount
AB 1171 estimate	April 2001	$469 million
Consultant's mock bid*	August 2002	$934 million
Engineer of record's estimate†	December 2002	$637 million
Caltrans' call-out number‡	February 2003	$733 million
Caltrans' mathematical update to the engineer of record's estimate§	June 2003	$703 million
Caltrans' mathematical update to the engineer of record's estimate§	October 2003	$726 million
Caltrans bridge cost estimating specialist‖	December 2003	$1.036 billion
Caltrans bridge cost estimating specialist‖	April 2004	$1.286 billion
Bid received by sole bidder#	May 2004	$1.399 billion (foreign steel) $1.804 billion (domestic steel)

Note: Estimates exclude supplemental work, state furnished items, and project contingency.

* Estimate was produced by Caltrans' value analysis consultant.

† Estimate represents the Caltrans consultant engineer of record's estimate.

‡ Estimate was based on final bid items for the advertised contract.

§ Estimate was based on Caltrans' mathematical update to individual contract line items based on addenda to plans and specifications. These addenda add payment provisions, correct errors, and add or eliminate bid items.

‖ The Caltrans director says the estimates of Caltrans' bridge cost estimating specialist were speculative and do not reflect the engineer of record's estimate at the time.

The single bid included domestic steel and foreign steel bids.

The Program Contingency Reserve Was Almost Completely Committed in November 2003

The program reserve that Caltrans reported to the FHWA was $122 million of the original $448 million budgeted in AB 1171.

This amount was grossly insufficient for several reasons:

- The bid for the signature span's superstructure was not yet received.
- Caltrans' internal estimates indicated that the superstructure would cost significantly more than expected.
- The skyway section of the East Span was only 31 percent constructed.

The Estimated Cost for the Richmond-San Rafael Bridge Was Higher Than Caltrans Reported to FHWA

Caltrans underreported to FHWA the estimated costs for the retrofit work to the Richmond-San Rafael Bridge.

In response to FHWA's questions, Caltrans asserted that the cost for the Richmond-San Rafael Bridge would be $570 million, but internal reports showed a total potential cost of $613 million to $648 million.

In its August 2004 report, Caltrans reported that the Richmond-San Rafael Bridge would incur additional costs overruns, which would raise the total estimated capital outlay cost for the project to $780 million.

The Skyway Was Less Than Half Constructed and Was Likely to Require Additional Funding to Cover Unforeseen Cost Increases

As of November 2003, the skyway was only 31 percent constructed, yet its projected cost was $302 million to $321 million over the AB 1171 estimate, and Caltrans reported having only a $20 million contingency reserve balance for the project.

In its August 2004 report, Caltrans stated that the skyway's estimated cost had increased $186 million beyond the amount it reported to FHWA in November 2003, with the total estimated capital cost for the skyway rising to $1.293 billion.

Caltrans Did Not Keep the Commission Informed of the Program's Cost Overruns

Caltrans has not updated the commission regularly on the program's cost overruns for ongoing projects and on changing cost estimates for the signature span.

The first time Caltrans officially disclosed to the commission that cost estimates for the seismic program would exceed the AB 1171 estimates, was a meeting between Caltrans and the commission on June 2, 2004, or seven days after Caltrans opened the bid for the signature span's superstructure.

In contrast, the commission contracts with Bechtel to monitor Caltrans' project management over Regional Measure 1 projects. Bechtel provides the commission a monthly progress report within 23 working days after each month. These monthly reports provide a mechanism to alert the commission promptly to potential cost and schedule problems.

RECOMMENDATIONS

To ensure that it properly manages the risks associated with large construction projects, Caltrans should continue to revise its risk management practices, but ensure that its efforts include:

- Establishing a comprehensive risk management plan that clearly defines roles and responsibilities for risk management, and addresses how it will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the life of the project.
- Quantifying the effect of identified risks in financial terms.
- Developing and maintaining documents to track identified risks and related mitigation steps.

To ensure that it follows generally accepted practices for cost management, Caltrans should:

- Regularly update its estimates of capital and support costs.
- Regularly reassess its reserves for potential claims and unknown risks, incorporating information related to risks identified and quantified through its risk assessment processes.
- Regularly integrate estimates for capital, support costs, and contingency reserves into a program-wide report.

To ensure that it keeps its stakeholders informed on the status of projects, Caltrans should:

- Submit quarterly status reports to the Legislature as the law requires.
- Ensure that reports to FHWA and other stakeholders reflect current data and provide accurate representation of the program's status.
- When key events occur, such as a bid opening for a major project, quickly inform stakeholders how these key events affect the program's overall budget and schedule.

The Legislature should consider revising state law to require that Caltrans submit its quarterly reports within a certain period after each quarter, such as 45 days.

The Legislature should also consider changing state law to require that the quarterly reports provide a program-wide summary of the programs' budget status for both capital outlay and support costs.

In reviewing the options that Caltrans presents for completing the East Span, the Legislature should consider requesting that Caltrans provide sufficient detail to understand the financial implications of each option.

This detail should include for each option a breakdown of the costs for capital outlay, support, and contingencies at the project and program level. Further, Caltrans should provide a reconciliation of each option to the figures it presented in its August 2004 report to the Legislature.